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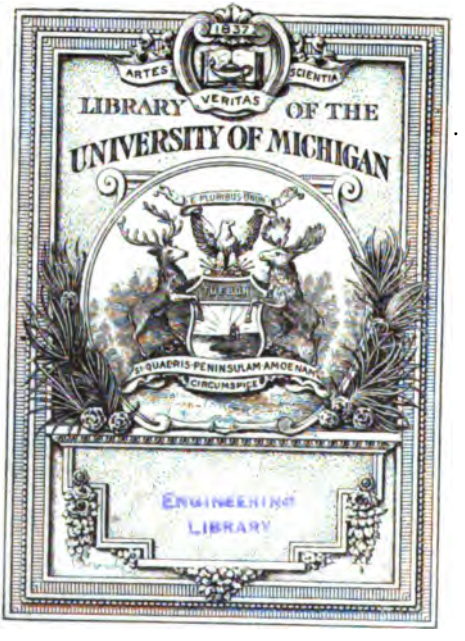

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ANNUAL REPORT

OF THE

SECRETARY OF WAR

FOR

THE YEAR 1895.

IN THREE VOLUMES.

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IMPROVEMENTS.—Waccamaw River, N. C. and S. C., 1391; Lumber River, N. C. and S. C., 1395; Little Pedee River, S. C., 1398; Great Pedee River, S. C., 1401; Clark River, S. C., 1404; Mingo Creek, S. C., 1405; Santee River, S. C., 1408; Wateree River, S. C., 1415; Congaree River, S. C., 1418; harbor at Charleston, S. C., 1421; Ashley River, S. C., 1433; Wappoo Cut, S. C., 1434; Edisto River, S. C., 1438; Salkahatchie River, S. C., 1440; Beaufort River, S. C., 1443; removing sunken vessels or craft obstructing or endangering navigation, 1447.

APPENDIX M.

REPORT OF CAPT. O. M. CARTER, CORPS OF ENGINEERS.

IMPROVEMENTS.—Savannah Harbor, Ga., 1449; Savannah River, Ga., 1465; Savannah River above Augusta, Ga., 1470; Darien Harbor, Ga., 1473; Altamaha River, Ga., 1477; Oconee River, Ga., 1481; Ocmulgee River, Ga., 1485; Brunswick Harbor, Ga., 1490; Brunswick Outer Bar, Ga., 1501; Jekyl Creek, Ga., 1504; Cumberland Sound, Ga., 1508; inside water route between Savannah, Ga., and Fernandina, Fla., 1515; removing sunken vessels or craft obstructing or endangering navigation, 1519.
SURVEYS.—Savannah River, Ga., between Spirit Island and point where Charleston and Savannah Railroad crosses, 1520; steamboat channel between Beaufort, S. C., and Savannah, Ga., 1521.

APPENDIX N.

REPORT OF MAJ. T. H. HANDBURY, CORPS OF ENGINEERS.

IMPROVEMENTS.—St. Johns River, Fla., 1529; Upper St. Johns River, Fla., 1534; Volusia Bar, Fla., 1536; Ocklawaha River, Fla., 1537; St. Augustine Harbor, Fla., 1539; Indian River, Fla., 1541; northwest entrance, Key West Harbor, Fla., 1546; Caloosahatchee River, Fla., 1549; Charlotte Harbor and Pease Creek, Fla., 1551; Sarasota Bay, Fla., 1553; Manatee River, Fla., 1555; Withlacoochee River, Fla., 1556; Suwanee River, Fla., 1558; removing sunken vessels or craft obstructing or endangering navigation, 1560.
EXAMINATIONS AND SURVEYS.—St. Johns River, Fla., at Orange Mills Flats, near Palatka, and channel to Sanford and points above, 1560; St. Lucia Inlet and River, Fla., 1564; entrance to Biscayne Bay, Fla., 1566; Tampa Bay, Fla., from Port Tampa to mouth, 1570; Anclote River, Fla., 1573; Crystal River, Fla., at its mouth, 1576; Withlacooche River, Fla., from mouth to head of navigation, 1579; St. Johns River, Fla., from Jacksonville to the ocean, 1586; harbor at Cape Canaveral, Fla., 1604.

APPENDIX O.

REPORT OF MAJ. F. A. MAHAN, CORPS OF ENGINEERS.

IMPROVEMENTS.—Apalachicola Bay, Fla., 1611; Apalachicola River, the Cut-off, and Lower Chipola River, Fla., 1615; Flint River, Ga., 1617; Chattahoochee River, Ga. and Ala., 1619; Choctawhatchee River, Fla. and Ala., 1626; harbor at Pensacola, Fla., 1629; Escambia and Conecuh rivers, Fla. and Ala., 1661; Alabama River, Ala., 1663; Coosa River, Ga. and Ala., 1670; operating and care of canals and other works of navigation on Coosa River, Ga. and Ala., 1679.
EXAMINATION.—Carrabelle Bar and Harbor, Fla., 1680.

APPENDIX P.

REPORT OF MAJ. A. N. DAMRELL, CORPS OF ENGINEERS.

IMPROVEMENTS.—Mobile Harbor, Ala., 1683; Black Warrior River, Ala., from Tuscaloosa to Daniels Creek, 1691; Warrior and Tombigbee rivers, Ala. and Miss., 1692; Noxubee River, Miss., 1699; Pascagoula River, Miss., 1700; Chickasahay River, Miss., 1703; Leaf River, Miss., 1704; harbor at Biloxi Bay, Miss., 1705; Pearl River below Jackson, Miss., 1706; Pearl River between Carthage and Jackson, Miss., 1708; Pearl River between Edinburg and Carthage, Miss., 1710; Bogue Chitto, La., 1711; removing sunken vessels or craft obstructing or endangering navigation, 1712.
EXAMINATIONS AND SURVEY.—Bar in Horn Island Pass, Miss., 1714; Noxubee River, Miss., from Macon to mouth of Hashuqua Creek, 1715; channel between Mobile Bay and Mississippi Sound, 1716.

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PART III.

APPENDIX Q.

REPORT OF MAJ. JAMES B. QUINN, CORPS OF ENGINEERS.

INSPECTION of the improvement of the South Pass of the Mississippi River, 1725.

APPENDIX R.

REPORT OF MAJ. JAMES B. QUINN, CORPS OF ENGINEERS.

IMPROVEMENTS.—Chefuncte River and Bogue Falia, La., 1742; Tickfaw River and its tributaries, La., 1744; Amite River and Bayou Manchac, La., 1747; Bayou Lafourche, La., 1750; Bayou Terrebonne, La., 1753; Bayou Plaquemine, Grand River, and Pigeon bayous, La., 1754; Bayou Courtableau, La., 1760; Bayou Teche, La., 1763; channel, bay, and passes of Bayou Vermilion, La., 1766; Mermentau River and tributaries, La., 1768; mouth and passes of Calcasieu River, La., 1770; harbor at Sabine Pass, Tex., 1771; Sabine River, Tex., 1778; Neches River, Tex., 1781; removing sunken vessels or craft obstructing or endangering navigation, 1782.

EXAMINATIONS.—Bayou Bonfuca, La., 1783; Chefuncte River and Bogue Falia, La., 1784; Tickfaw River and tributaries, La., 1786; Bayou Teche, La., from St. Martinville to Port Barre, 1788; channel through Sabine Lake, Tex., from mouths of Sabine and Neches rivers to head of pass to Gulf of Mexico, 1790.

APPENDIX S.

REPORT OF CAPT. JOHN MILLIS, CORPS OF ENGINEERS.

EXAMINATIONS.—Baton Rouge Harbor, La., 1793; harbor at Bayou Sara, La., 1795.

APPENDIX T.

REPORT OF MAJ. A. M. MILLER, CORPS OF ENGINEERS.

IMPROVEMENTS.—Entrance to Galveston Harbor, Tex., 1797; ship channel in Galveston Bay, Tex., 1806; channel in West Galveston Bay, Tex., 1809; Trinity River, Tex., 1813; Cedar Bayou, Tex., 1815; Buffalo Bayou, Tex., 1816; harbor at Brazos Santiago, Tex., 1819.

EXAMINATIONS AND SURVEY.—Colorado River from mouth to Wharton, Tex., 1821; Guadalupe River, Tex., from mouth to Cuero, 1826; bar and harbor at Brazos Santiago, Tex., 1830; Brazos River, Tex., from Waco to Richmond, 1833; Brazos River, Tex., from Velasco to Richmond, 1838.

APPENDIX U.

REPORT OF CAPT. J. H. WILLARD, CORPS OF ENGINEERS.

IMPROVEMENTS.—Red River, La. and Ark., 1848; Red River above Fulton, Ark., 1881; Cypress Bayou, Tex. and La., 1885; Ouachita and Black rivers, Ark. and La., 1887; bayous D'Arbonne and Corney, La., 1914; Bayou Bartholomew, La. and Ark., 1917; Bœuf River, La., 1920; Tensas River and Bayou Maçon, La., 1923; Big Black River, Miss., 1926; Yazoo River, Miss., 1929; mouth of the Yazoo River, Miss., 1933; Tchula Lake, Miss., 1942; Tallahatchie River, Miss., 1945; Steele and Washington bayous, Miss., 1948; Big Sunflower River, Miss., 1949; Big Hatchee River, Tenn., 1952; water gauges on Mississippi River and its principal tributaries, 1955.

EXAMINATIONS.—Bayou Dugdemona, La., 1961; Bayou Castor, La., 1962; Little River, Ark., from Fulton to White Cliffs, 1965; Bœuf River, Ark., above Wallaces Landing, 1969; Bayou Maçon, Ark., above Floyd, 1974; Yalobusha River, Miss., 1979; Little River, La., 1984; Bogue Phalia, Miss., at "The Narrows," 1988; Bear Creek, Miss., 1990.

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APPENDIX V.

REPORT OF LIEUT. WILLIAM L. SIBERT, CORPS OF ENGINEERS.

IMPROVEMENTS.—Removing obstructions in Arkansas River, Ark. and Kans., 1995; Arkansas River, Ark., 1998; Fourche Le Fevre River, Ark., 2013; Petit Jean River, Ark., 2015; White River, Ark., 2017; Cache River, Ark., 2024; Black River, Ark. and Mo., 2025; Current River, Ark. and Mo., 2029; St. Francis River, Ark., 2031; St. Francis River, Mo., 2035; removing sunken vessels or craft obstructing or endangering navigation, 2037.
EXAMINATIONS.—Cache River to Riverside, Ark., 2037; St. Francis River, from the Sunk Lands to Greenville, Mo., 2040.

APPENDIX W.

REPORT OF MAJ. CHARLES J. ALLEN, CORPS OF ENGINEERS.

IMPROVEMENTS.—Removing snags and wrecks from Mississippi River, 2043; Mississippi River between Ohio and Missouri rivers, 2059; harbor at St. Louis, Mo., 2091; Kaskaskia River, Ill., 2093.

APPENDIX X.

REPORT OF LIEUT. CHARLES KELLER, CORPS OF ENGINEERS.

IMPROVEMENTS.—Operating snag boats and dredge boats on Upper Mississippi River, 2095; Mississippi River between mouth of Missouri River and Minneapolis, 2108; operating and care of Des Moines Rapids Canal and Dry Dock, 2152; operating and care of Galena River improvement, Ill., 2157; Mississippi River between Minneapolis and St. Paul—construction of Lock and Dam No. 2, 2158.
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APPENDIX Y.

REPORT OF MAJ. W. A. JONES, CORPS OF ENGINEERS.

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EXAMINATIONS.—Minnesota River, Minn., with view to protecting banks opposite borough of Belle Plaine and at and near Mankato, 2206; Big Stone Lake, Minn., with view to construction of reservoirs, 2208; Red Lake River, Minn., from Thief River Falls to Red Lake, 2211.

APPENDIX Z.

REPORT OF CAPT. H. F. HODGES, CORPS OF ENGINEERS.

IMPROVEMENTS.—Missouri River between Stubbs Ferry, Mont., and the lower limits of Sioux City, Iowa, 2213; removal of snags and other obstructions in Missouri River above Sioux City, Iowa, 2238; Yellowstone River, Mont. and N. Dak., 2240; examination of Nebraska side of the Missouri River opposite Sioux City, Iowa, 2240; Tongue River, Mont., 2243.

APPENDIX A A.

REPORT OF CAPT. JOHN BIDDLE, CORPS OF ENGINEERS.

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SURVEY.—Forked Deer River, from Dyersburg, Tenn., to the Obion River and thence to the Mississippi, 2265.

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APPENDIX B B.

REPORT OF CAPT. THEO. A. BINGHAM, CORPS OF ENGINEERS.

IMPROVEMENTS.—Tennessee River, 2283; operating and care of Muscle Shoals Canal, Tennessee River, 2305; Hiwassee River, Tenn., 2311; French Broad and Little Pigeon rivers, Tenn., 2313; Clinch River, Tenn., 2318.

APPENDIX C C.

REPORT OF LIEUT. COL. AMOS STICKNEY, CORPS OF ENGINEERS.

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REPORT OF MAJ. R. L. HOXIE, CORPS OF ENGINEERS.

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APPENDIX E E.

REPORT OF CAPT. J. G. WARREN, CORPS OF ENGINEERS.

IMPROVEMENTS.—Falls of the Ohio River at Louisville, Ky., 2427; Indiana Chute, Falls of the Ohio River, 2431; operating and care of Louisville and Portland Canal, Ky., 2434; Wabash River, Ind. and Ill., 2441; White River, Ind., 2445.

APPENDIX F F.

REPORT OF LIEUT. COL. PETER C. HAINS, CORPS OF ENGINEERS.

IMPROVEMENTS.—Great Kanawha River, W. Va., 2447; operating and care of locks and dams on Great Kanawha River, W. Va., 2458; Elk River, W. Va., 2460; Gauley River, W. Va., 2462; New River, Va. and W. Va., 2465.
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APPENDIX G G.

REPORT OF MAJ. D. W. LOCKWOOD, CORPS OF ENGINEERS.

IMPROVEMENTS.—Tradewater River, Ky., Lock No. 2, Green River, at Rumsey, Ky., 2470; Green River, above mouth of Big Barren River, Ky. (Lock No. 5), 2473; operating and care of locks and dams on Green and Barren rivers, Ky., 2475; Rough River, Ky., 2481; Kentucky River, Ky., 2484; operating and care of locks and dams on Kentucky River, Ky., 2489; Licking River, between Farmers and West Liberty, Ky., Big Sandy River, W. Va. and Ky., 2498; Levisa Fork of Big Sandy River, Ky., 2503; Tug Fork of Big Sandy River, W. Va. and Ky., 2505; Guyandotte River, W. Va., 2508; Little Kanawha River, W. Va., 2510; operating and care of lock and dam on Little Kanawha River, W. Va., 2511.
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PART IV.

APPENDIX H H.

REPORT OF MAJ. CLINTON B. SEARS, CORPS OF ENGINEERS.

IMPROVEMENTS.—Harbor at Grand Marais, Minn., 2528; harbor at Agate Bay, Minn., 2530; harbor at Duluth, Minn., 2533; harbor at Superior Bay and St. Louis Bay, Wis., 2549; harbor at Ashland, Wis., 2554; harbor at Ontonagon, Mich., 2557; Eagle Harbor, Mich., 2560; waterway from Keweenaw Bay to Lake Superior, Mich., 2561; harbor at Marquette, Mich., 2571; harbor of refuge at Grand Marais, Mich., 2576.
EXAMINATIONS AND SURVEYS.—Harbors of Superior, Wis., and Duluth, Minn., 2579; mouth of Iron River, Lake Superior, Flag Lake, and mouth of Flag River, Wis., 2580; Allouez Bay, Wis., 2584; canal connecting Lake Superior and Mississippi River, 2587.
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APPENDIX I I.

REPORT OF CAPT. CARL T. PALFREY, CORPS OF ENGINEERS.

IMPROVEMENTS.—Manistique Harbor, Mich., 2592; Cedar River Harbor, Mich., 2593; Menominee Harbor, Mich. and Wis., 2595; Menominee River, Mich. and Wis., 2599; Oconto Harbor, Wis., 2600; Pensaukee Harbor, Wis., 2602; Green Bay Harbor, Wis., 2603; Sturgeon Bay and Lake Michigan Canal, Wis., 2606; operating and care of Sturgeon Bay and Lake Michigan Canal, Wis., 2612; harbor of refuge at entrance of Sturgeon Bay and Lake Michigan Canal, Wis., 2614; Ahnapee Harbor, Wis., 2617; Kewaunee Harbor, Wis., 2620; Two Rivers Harbor, Wis., 2623; Manitowoc Harbor, Wis., 2626; Sheboygan Harbor, Wis., 2630; Port Washington Harbor, Wis., 2634; harbor of refuge at Milwaukee Bay, Wis., 2637; Milwaukee Harbor, Wis., 2640; Racine Harbor, Wis., 2645; Kenosha Harbor, Wis., 2649; Waukegan Harbor, Ill., 2653; Fox River, Wis., 2657; operating and care of locks and dams on Fox River, Wis., 2666; removing sunken vessels or craft obstructing or endangering navigation, 2681.
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APPENDIX J J.

REPORT OF MAJ. W. L. MARSHALL, CORPS OF ENGINEERS.

IMPROVEMENTS.—Chicago Harbor, Ill., 2693; Calumet Harbor, Ill., 2701; Calumet River, Ill. and Ind., 2706; Illinois River, Ill., 2714; operating and care of La Grange and Kampsville locks and dams, Illinois River, Ill., 2723; Illinois and Mississippi Canal, Ill., 2726, 2770.
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REPORT OF LIEUT. COL. G. J. LYDECKER, CORPS OF ENGINEERS.

IMPROVEMENTS.—Michigan City Harbor, Ind., 2776; St. Joseph Harbor, Mich., 2782; St. Joseph River, Mich., 2786; South Haven Harbor, Mich., 2787; Saugatuck Harbor, Mich., 2790; Holland (Black Lake) Harbor, Mich., 2793; Grand Haven Harbor, Mich., 2795; Muskegon Harbor, Mich., 2799; White Lake Harbor, Mich., 2802; Pentwater Harbor, Mich., 2804; Ludington Harbor, Mich., 2806; Manistee Harbor, Mich., 2808; harbor of refuge at Portage Lake, Manistee County, Mich., 2811; Frankfort Harbor, Mich., 2813; Charlevoix Harbor, Mich., 2816; Petoskey Harbor, Mich., 2818; dredging at harbors on east shore of Lake Michigan, 2822; Cheboygan Harbor, Mich., 2823; Alpena Harbor (Thunder Bay River) Mich., 2826; Saginaw River, Mich., 2828; harbor of refuge at Sand Beach, Lake Huron, Mich., 2831; Black River at Port Huron, Mich., 2834; mouth of Black River, Mich., 2836; Clinton River, Mich., 2837; Rouge River, Mich., 2839; turning basin in Rouge River, Mich., removing sunken vessels or craft obstructing or endangering navigation, 2840.
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APPENDIX L L.

REPORT OF COL. O. M. POE, CORPS OF ENGINEERS.

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PART V.

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REPORT OF LIEUT. COL. JARED A. SMITH, CORPS OF ENGINEERS.

IMPROVEMENTS.—Monroe Harbor, Mich., 3071; Toledo Harbor, Ohio, 3074; Port Clinton Harbor, Ohio, 3081; Sandusky Harbor, Ohio, 3083; Sandusky River, Ohio, 3091; Huron Harbor, Ohio, 3092; Vermilion Harbor, Ohio, 3096; Black River Harbor, Ohio, 3097; Cleveland Harbor, Ohio, 3100; Fairport Harbor, Ohio, 3107; Ashtabula Harbor, Ohio, 3113; Conneaut Harbor, Ohio, 3117.
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APPENDIX N N.

REPORT OF MAJ. E. H. RUFFNER, CORPS OF ENGINEERS.

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APPENDIX O O.

REPORT OF CAPT. DAN C. KINGMAN, CORPS OF ENGINEERS.

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APPENDIX P P.

REPORT OF CAPT. SMITH S. LEACH, CORPS OF ENGINEERS.

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APPENDIX Q Q.

REPORT OF COL. G. H. MENDELL, CORPS OF ENGINEERS.

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APPENDIX R R.

REPORT OF LIEUT. COL. W. H. H. BENYAURD, CORPS OF ENGINEERS.

IMPROVEMENTS.—Napa River, Cal., 3263; Redwood Creek, Cal., San Luis Obispo Harbor, Cal., 3265; Wilmington Harbor, Cal., 3268; San Diego Harbor, Cal., 3273; Colorado and Gila rivers, at Yuma, Ariz., 3278.
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APPENDIX S S.

REPORT OF MAJ. W. H. HEUER, CORPS OF ENGINEERS.

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APPENDIX T T.

REPORT OF CAPT. THOMAS W. SYMONS, CORPS OF ENGINEERS.

IMPROVEMENTS.—Coquille River, Oreg., 3344; Coquille River, Oreg., between Coquille City and Myrtle Point, 3348; entrance to Coos Bay and Harbor, Oreg., 3357; Harbor at Coos Bay, Oreg. (dredging), 3367; Umpqua River, Oreg., 3369; mouth of Siuslaw River, Oreg., 3372; Yaquina Bay, Oreg., 3375; Tillamook Bay and Bar, Oreg., 3382; entrance to Nehalem Bay, Oreg., 3386; Upper Snake River, Idaho, between Huntington Bridge and Seven Devils mining district, 3388; Upper Columbia and Snake rivers, Oreg. and Wash., 3391; Columbia River between head of Rock Island Rapids and foot of Priest Rapids, Wash., 3393; Columbia River from Rock Island Rapids to Foster Creek Rapids, Wash., 3395; Willapa River and Harbor, Wash., 3399; Grays Harbor and Chehalis River, Wash., 3405; Chehalis River, Wash., 3413; harbor at Olympia, Wash., 3416; waterway connecting Puget Sound with Lakes Union and Washington, 3422; Everett Harbor, Wash., 3430; Swinomish Slough, Wash., 3435; Puget Sound and its tributary waters, Wash., 3442.
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HARBOR LINES.—Puget Sound, at Seattle and Ballard, Wash., 3453; Hoquiam Harbor, Wash., 3547.

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APPENDIX U U.

REPORT OF MAJ. JAMES C. POST, CORPS OF ENGINEERS.

IMPROVEMENTS.—Mouth of Columbia River, Oreg. and Wash., 3551; Columbia and Lower Willamette rivers below Portland, Oreg., 3561; Columbia River between Vancouver, Wash., and mouth of Willamette River, 3566; canal at the Cascades, Columbia River, Oreg., 3568; Columbia River at Three-mile Rapids, and boat railway from The Dalles Rapids to Celilo Falls, 3589; Willamette River above Portland, and Yamhill River, Oreg., 3591; Cowlitz River, Wash., 3594; Youngs and Klasquine rivers, 3595; gauging waters of Columbia River, Oreg. and Wash., 3596.

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APPENDIX V V.

REPORT OF LIEUT. COMMANDER DANIEL DELEHANTY, UNITED STATES NAVY.

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PART VI.

APPENDIX W W.

REPORT OF THE MISSISSIPPI RIVER COMMISSION.

C. B. COMSTOCK, colonel, Corps of Engineers, bvt. brig. gen., U. S. A., president to February 3, 1895; G. L. GILLESPIE, lieutenant-colonel, Corps of Engineers, U. S. A., president since February 15, 1895; CHARLES R. SUTER, lieutenant-colonel, Corps of Engineers, U. S. A.; AMOS STICKNEY, lieutenant-colonel, Corps of Engineers, U. S. A.; HENRY L. WHITING, assistant, U. S. Coast and Geodetic Survey; B. M. HARROD, ROBERT S. TAYLOR, and HENRY FLAD, *commissioners.*

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ANNUAL REPORT

OF THE

CHIEF OF ENGINEERS,

UNITED STATES ARMY.

1895.

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REPORT

OF

THE CHIEF OF ENGINEERS,

UNITED STATES ARMY.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., September 28, 1895.

SIR: I have the honor to present for your information the following report upon the duties and operations of the Engineer Department for the fiscal year ending June 30, 1895:

OFFICERS OF THE CORPS OF ENGINEERS.

The number of officers holding commissions in the Corps of Engineers, U. S. Army, at the end of the fiscal year was 118.

Since the last annual report the Corps has lost by retirement and death six of its officers: Brig. Gen. Thomas Lincoln Casey, who was retired May 10, 1895; Col. Cyrus B. Comstock, who was retired February 3, 1895, and Col. George H. Elliot, who was retired March 31, 1895, all three under provisions of section 1 of the act of Congress approved June 30, 1882; and Maj. John C. Mallery, who was retired January 26, 1895, under the provisions of section 1251, Revised Statutes; Maj. Thomas Turtle, who died September 18, 1894; and Capt. Philip M. Price, who died October 4, 1894.

There were added to the Corps, by promotion of graduates of the Military Academy, two additional second lieutenants July 10, 1894, and two June 17, 1895.

On the 30th of June, 1895, the officers were distributed as follows:

Commanding the Corps of Engineers and the Engineer Department	1
Office of the Chief of Engineers and Missouri River Commission	1
Office of the Chief of Engineers and Light-House Board	1
Office of the Chief of Engineers	1
Board of Engineers, fortifications, river and harbor works, California Débris Commission, and Division Engineer	1
Board of Engineers, Board of Ordnance and Fortification, and Division Engineer.	1
River and harbor works and Division Engineer	1
Board of Engineers, fortifications, river and harbor works, and Board of Visitors	1
Board of Engineers, fortifications, river and harbor works, Division Engineer, and Board of Visitors	1
Public buildings and grounds and Light-House Board	1
Board of Engineers, Mississippi River Commission, fortifications, river and harbor works, and Board of Visitors	1
Mississippi River Commission, Missouri River Commission, and light-house districts	1

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River and harbor works and light-house district	1
Fortifications and river and harbor works	22
Fortifications, post of Willets Point, U. S. Engineer School, and Battalion of Engineers	1
Fortifications, river and harbor works, and California Débris Commission	1
Mississippi River Commission, river and harbor works, and light-house district	1
Missouri River Commission and river and harbor works	2
Board of Engineers, fortifications, and river and harbor works	1
River and harbor works	30
River and harbor works, California Débris Commission, and light-house district	1
Fortifications, river and harbor works, and light-house districts	3
Washington Aqueduct	1
River and harbor works and engineer officer, Department of the Missouri	1
Battalion of Engineers and U. S. Engineer School	14
Mississippi River Commission	1
California Débris Commission	1
Fortifications, river and harbor works, and International Boundary Commission	1
Public buildings and grounds	1
Awaiting orders	1
Leave of absence, including two graduates of the Military Academy	5
Detached, on International Boundary Commission, at Military Academy, as military attaché, and Nicaragua Canal Board, with Light-House Establishment, and with Board of Commissioners of the District of Columbia	17
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The officers detached were on duty as follows:

Lieut. Col. John W. Barlow, member of International Boundary Commission	1
Lieut. Col. Oswald H. Ernst, Superintendent Military Academy	1
Maj. William Ludlow, military attaché to the U. S. embassy at London and member of Nicaragua Canal Board	1
Maj. Milton B. Adams, engineer Ninth and Eleventh light-house districts	1
Maj. William R. Livermore, engineer First and Second light-house districts	1
Maj. Charles F. Powell, Engineer Commissioner of the District of Columbia	1
Capt. Eric Bergland, engineer Fifth and Sixth light-house districts	1
Capt. James L. Lusk and Lieuts. Mason M. Patrick and Charles S. Bromwell, on duty with Company E, Battalion of Engineers, and at Military Academy	3
Capts. Gustav J. Fiebeger, Edward Burr, and Lansing H. Beach, assistants to the Engineer Commissioner of the District of Columbia	3
Capt. John Millis, engineer secretary of the Light-House Board	1
Lieuts. Henry C. Newcomer, Thomas H. Rees, and Clement A. F. Flagler, on duty at the Military Academy	3
	17

FORTIFICATIONS.

The regulations for the government of the Corps of Engineers provide for a Board of Engineers. One of the duties of this board is to plan or to revise, as may be directed by the Chief of Engineers from time to time, projects of permanent fortifications required for the defense of the territory of the United States.

The board consists of not less than three officers, to be designated by the Chief of Engineers, with the sanction of the Secretary of War. Whenever the defense of any particular locality is under consideration by the board the corresponding division engineer is also a member of the board, and the district engineer may be associated with the board as a member thereof whenever any subject relating to his district is under consideration.

The composition of this board during the past fiscal year is given on page 15 of this report.

March 29, 1887, The Board of Engineers was instructed to prepare plans for the defense of our more important harbors. Under these instructions the board undertook a thorough revision of plans for the defense of our chief ports by submarine mines and a study of the precise locations for the new armaments rendered necessary by modern modes of attack.

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At the close of the fiscal year ending June 30, 1894, projects had been prepared for the artillery defense of Portland, Me., Boston, Narragansett Bay, the eastern entrance of Long Island Sound, New York, Baltimore, Washington, Hampton Roads, Wilmington, N. C., Charleston, S. C., Savannah, Pensacola, Mobile, and San Francisco. Since that date the board has prepared projects for the artillery defense of Philadelphia, Key West, San Diego, the mouth of the Columbia River, Galveston, and of Puget Sound. In addition, projects for the submarine mine defense of various places have been prepared or revised.

Nearly all of these have from time to time been submitted to and received the approval of the Secretary of War.

If we take the case of Portland, Me., it will be seen that the project calls for 38 guns of large caliber and 48 mortars, while emplacements are being built for but 3 guns; that at New York 45 guns and 176 mortars are called for, and emplacements built or building for but 11 guns and 32 mortars. It is not necessary to refer to the projects for the defense of other places; enough has been said to demonstrate that fortifying our seacoasts has barely been entered upon. The tables below set forth the appropriations that have been made to date for these works.

Appropriations for batteries and their platforms have been made in amounts, and by acts of Congress approved, as follows:

Act.	Batteries.	Platforms.
Aug. 18, 1890	$1,221,000	
Feb. 24, 1891	750,000	
July 23, 1892	500,000	
Feb. 18, 1893		$50,000
Aug. 1, 1894	400,000	100,000
Mar. 2, 1895	400,000	100,000
Total	3,271,000	250,000

From the appropriations for batteries allotments have been made for emplacements for fourteen 12-inch, twenty-one 10-inch, and seven 8-inch guns and eighty 12-inch mortars at places as follows: Portland, Me., Boston, Mass., New York, N. Y., Philadelphia, Pa., Washington, D. C., Hampton Roads, Va., Charleston, S. C., Pensacola, Fla., Mobile, Ala., New Orleans, La., and San Francisco, Cal.

Allotments have been made for platforms for fifteen 10-inch and five 8-inch guns and 20 mortars in addition to those made for platforms on which guns and mortars are now mounted.

Detailed estimates are still to be prepared for the cost of constructing platforms for five 12-inch guns on nondisappearing carriages, six 10-inch and two 8-inch guns on disappearing carriages, and sixteen 12-inch mortars. After applying the available balance the sum of $70,000 will probably be needed to complete these platforms, and an estimate of that amount is submitted.

The defenses of the various cities and harbors include not only gun and mortar batteries, but also submarine mines operated from mining casemates. The necessity of these obstructions to an enemy's passage can not be more concisely stated than was stated in the Report of 1886 of the Board on Fortifications or other Defenses, as follows:

> Heavy batteries and submarine mines are correlative terms of a good defense from shore. Without powerful guns in the defense the armored ships of the enemy would proceed deliberately to the removal of the mines, either ignoring or silencing the fire of the works, and without the aid of the mines the enemy's vessels could not generally be prevented from running past the batteries.

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These mines are operated from shot-proof casemates and are connected to the operating apparatus in these casemates by cables traversing cable galleries.

A few casemates and galleries had been constructed prior to 1888, but in that and the three subsequent years $482,581.08 was appropriated for further constructions of this character. March 2, 1895, $20,000 was also appropriated for the same purpose. With these funds 25 casemates have been completed for the defense of Portland, Me., Boston, Narragansett Bay, New York, Philadelphia, Baltimore, Washington, Hampton Roads, Charleston, Savannah, Pensacola, and San Francisco, and 3 are building for Boston, Wilmington, N. C., and Mobile. A balance of $15,919.80 will shortly be allotted to the construction of a casemate at Galveston, Tex. An estimate of $50,000 is submitted for additional casemates.

The act of March 2, 1895, also appropriated $20,000 for the purchase of submarine mines and necessary appliances. This amount is all pledged and should be supplemented by future annual appropriations, as the material is not such as can be improvised in case of an emergency. An estimate of $50,000 is submitted.

Details of the progress made under the various allotments for construction of gun and mortar batteries and of mining casemates during the past fiscal year will now be given:

Portland Harbor, Maine.—Officers in charge, Lieut. Col. P. C. Hains, Corps of Engineers, until November 5, 1894, and Lieut. Col. D. P. Heap, Corps of Engineers, since that date.

Emplacements for two 10-inch rifles were completed in November 1894, except the details necessary to accommodate the gun carriages. The entire cost of the two emplacements has been $90,261.05. The amount allotted for these was $110,000. An additional allotment of $5,000 was made, and with the amount thus made available the construction of an emplacement for another 10-inch gun was commenced. The excavation for this is now nearly completed. The expenditures on account of this have been $7,095.70, leaving an available balance of $8,338.11 after deduction of outstanding liabilities and amounts covered by uncompleted contracts.

An allotment of $1,200 was made August 7, 1894, for a survey preliminary to the preparation for construction of other defensive works, and the field work of the survey was completed November 16, 1894. The balance unexpended on this work July 1, 1895, was $20.93.

The transfer of the school site on the Fort McClary Military Reservation, Me., to School District No. 12, Kittery, Me., has been completed. During the past fiscal year the schoolhouse was moved to the new site, and the site graded. The amount appropriated by act of Congress approved January 23, 1893, for this transfer was $900. The balance available July 1, 1895, was $152.10, not including the account of the district attorney for services in connection with the transfer.

Two mining casemates were completed in October, 1894, at a cost of $17,968.92, leaving an unexpended balance of the allotment amounting to $1,469.08.

(See Appendix No. 1.)

Boston Harbor, Massachusetts.—Officer in charge, Lieut. Col. S. M. Mansfield, Corps of Engineers.

Estimates of the cost of construction of four platforms on which to mount disappearing gun carriages for 10-inch rifles have been prepared, and an allotment made for the work. Four emplacements will be put

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in condition to receive their guns, the construction of the emplacements being otherwise essentially completed. The available balance of the allotments for these emplacements, July 1, 1895, was $22,722.71.

Eight mortars have been mounted on a battery for 16 mortars and the platforms for 4 others well advanced toward completion. The available balance of the allotment for this mortar battery, including mounting mortars, was $21,428.54.

The construction of a third mining casemate was continued. The masonry casemate and gallery were finished and the sand cover essentially completed.

Of the allotment of $27,000 made for this casemate all but $68.51 has been expended.

Narragansett Bay, Rhode Island.—Officers in charge, Capt. W. H. Bixby, Corps of Engineers, with First Lieut. W. W. Harts, Corps of Engineers, under his immediate orders until June 8, 1895, and First Lieut. W. W. Harts, Corps of Engineers, in temporary charge since that date; Division Engineer, Col. H. L. Abbot, Corps of Engineers.

The endeavors of the United States were continued to secure legal possession of a disputed area of three-fourths of an acre near the southeast corner of the Government reservation at Fort Adams. In a suit of ejectment judgment was rendered for the defendants, but further proceedings of the nature of a suit in equity to determine and fix the United States boundaries will be instituted.

Two mining casemates, for which allotments were made September 21 and October 20, 1892, have been completed, except in some minor details.

(See Appendix No. 1.)

New York Harbor, New York.—Officers of the Corps of Engineers in charge, Lieut. Col. H. M. Robert, with First Lieut. W. E. Craighill as assistant; Lieut. Col. G. L. Gillespie, with First Lieut. R. McGregor as assistant and in temporary charge from July 5 to October 23, 1894, and Lieut. Col. W. R. King.

All of the mining casemates required for the submarine mine defense of the harbor are completed.

Colonel Robert reports that construction work on a battery for five 8-inch rifles was suspended, on account of lack of funds, until about April 1, 1895. Authority has been given to complete this battery by building the remaining fifth emplacement and 5 platforms, and at the end of the year the masonry of the fifth emplacement and of 4 platforms is well advanced.

The sum of $3,323.51 is required to put a fireproof building for storage of submarine mining matériel in condition for service. Concrete flooring is required, and the machinery for handling mines and a small amount of work to finish incomplete details.

(See Appendix No. 1.)

Lieutenant-Colonel Gillespie reports as follows: Of a battery of seven 10-inch disappearing guns, 1 emplacement, 2 magazines, and 2 casemates for rapid-fire guns are under construction.

During the year, the drainage system was put in the slopes of the parapet, and magazine covering graded and sodded, the interior and exterior pavement laid, the doors made and hung, and casemates prepared for rapid-fire guns.

The original estimated cost of this battery is $413,290.40, but work already completed justifies the reduction of this estimate to $392,023.60. This estimate is for masonry construction and earth excavation and embankment, and does not include the cost of platform construction.

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The emplacement is finished as far as can be done until its platform is constructed. Based upon an estimate of cost submitted, an allotment of $3,638.25 has been made for its construction, and the work will be undertaken on delivery of the Buffington-Crozier disappearing carriage, which is to be mounted on this platform. The delivery of the carriage is expected about October 1, next.

A second gun has been mounted during the past year in a battery for two 12-inch rifles on lifts, which completed that battery, and in October, 1894, a battery for sixteen 12-inch mortars with ditch defense, including mounting the mortars, was completed.

The two-gun battery is used from time to time for experimental firing. Either gun can be raised from the loading to the firing position in fifteen seconds and completely lowered again in the same time. The ammunition can be raised from the magazine floor to the gun in seven seconds.

The cost of the battery, without armament, was $455,028.23.

The proof firing of 5 rounds from each mortar of the mortar battery was completed on November 27. The final battery firing, consisting of 2 rounds fired at horizontal targets, took place April 11, 1895.

An electric lighting system was installed in the battery in March, 1895, and at an early date an overhead trolley will be put along the longitudinal gallery for handling projectiles.

The total expenditures reported on this battery, including cost of platform, mounting, and assembling mortars, are $274,052; the cost of 16 cast-iron steel-hooped mortars and their spring-return carriages is reported as $264,000.

(See Appendix No. 1.)

Lieutenant-Colonel King reports as to the construction of emplacements for one 8-inch and two 10-inch guns, that they were completed in the spring of 1894, as far as authorized, until the gun platforms can be built. Estimates of the cost of constructing the platforms for 10-inch guns have been prepared. The necessary allotment therefor has been made.

Extensive repairs were made to the wharf at which heavy materials for the construction of these emplacements are unloaded.

In the mortar battery 4 carriages and their mortars have been mounted in one pit; the excavation of the other three pits has been completed, and 6 platforms are in advanced stages of construction. Four mortars and their carriages are on hand for the three pits, and the remaining 8 mortars and carriages are held by the Ordnance Department in readiness for shipment to the battery.

Magazines, loading rooms, and about one-half of the galleries have been floored with 5 inches of concrete. Entrance passages have been excavated and their walls built; unloading of sand and building embankments have been continued.

Philadelphia, Pa.—Officer in charge, Maj. C. W. Raymond, Corps of Engineers, with Second Lieut. Spencer Cosby, Corps of Engineers, assistant; Division Engineer, Col. H. L. Abbot, Corps of Engineers.

The sum of $260,000 was allotted August 11, 1894, to be applied to the construction of the 3-gun lift battery. Antiquated works heretofore constructed covered the site of this battery; much of these works has been removed, landing piers and temporary workshops repaired, and contracts entered into for materials and plant.

The type plans have been studied, and working drawings are now nearly completed. Two hundred and fourteen thousand and eighty-two dollars and sixty-eight cents of the allotment was available July 1, 1895, and the officer in charge reports that these funds can profitably

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be expended during the present fiscal year, and the sum of $410,000 during the fiscal year ending June 30, 1897. This latter sum includes the cost of two lifts and the mechanism.

The mining casemates required for this harbor are completed.

(See Appendix No. 1.)

Washington, D. C.—In the charge of Maj. C. E. L. B. Davis, Corps of Engineers, with First Lieut. D. DuB. Gaillard, Corps of Engineers, as assistant since February 12, 1895; Division Engineer, Col. W. P. Craighill, Corps of Engineers, until May 10, 1895; Brig. Gen. W. P. Craighill, Chief of Engineers, from May 10 to 18, 1895, and Lieut. Col. P. C. Hains, Corps of Engineers, since the last-named date.

The construction of emplacements for two 10-inch guns had been carried, September, 1893, as far as was possible until details of carriages were decided upon. This has been done, and estimates of the cost of constructing platforms for the disappearing gun carriages have been prepared, and the necessary allotment made. It is expected that these platforms will be constructed in the near future.

Hampton Roads, Virginia.—In the charge of Maj. C. E. L. B. Davis, Corps of Engineers, with First Lieut. D. DuB. Gaillard, Corps of Engineers, as assistant since February 12, 1895; Division Engineer, Col. W. P. Craighill, Corps of Engineers, until May 10, 1895; Brig. Gen. W. P. Craighill, Chief of Engineers, from May 10 to 18, 1895, and Lieut. Col. P. C. Hains, Corps of Engineers, since the last-named date.

Emplacements for three 10-inch guns have been completed as far as can be done until the construction of the platforms is undertaken. Plans and estimates for this latter work have been received, and the necessary allotment has been made.

An allotment of $100,000 has been made for commencing the construction of a mortar battery. A topographical survey of the site and borings and a chart have been made, and at the close of the fiscal year the plans and estimates were nearly completed. Extensive repairs to the wharf at which material for this battery will be landed are under way.

(See Appendix No. 1.)

Special works at Fort Monroe, Va.—In the charge of Maj. C. E. L. B. Davis, Corps of Engineers, with First Lieut. D. DuB. Gaillard, Corps of Engineers, as assistant since February 12, 1895; Division Engineer, Col. W. P. Craighill, Corps of Engineers, until May 10, 1895; Brig. Gen. W. P. Craighill, Chief of Engineers, from May 10 to 18, 1895, and Lieut. Col. P. C. Hains, Corps of Engineers, since the last-named date.

Sewerage system.—The sewerage system of the fort proper, as well as the arrangements for sewage disposal outside, were very defective.

Congress, by act of August 1, 1894, appropriated the sum of $37,500 for one-half of the cost of construction of a sewerage system for all buildings at Fort Monroe, Va., with the proviso that the owners of hotels and other nonmilitary buildings should bear one-half of the expense of constructing said sewer, and the Secretary of War was authorized to apportion among, assess, and collect from said owners the moiety of the estimated cost.

After due consideration it was decided that a civilian expert be employed. A project was therefore devised by Mr. Rudolph Hering at an estimated cost of $41,320, with a proviso that it might be well to have an extra bid for concrete, timber, and brickwork in case additional quantities should be required. To cover these contingencies, as well as cost of inspection, superintendence, fee of expert, etc., the estimated cost was increased to $45,000, and on that the moiety was

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assessed on the nonmilitary residents by order of the Secretary of War, in accordance with the table contained in the regulations for the construction of sewer at Fort Monroe, published in War Department Circular of November 5, 1894.

Much delay was experienced in starting the work, owing to the failure of the Hampton Roads Hotel Company to pay its assessment promptly.

The contract was entered into January 29, 1895, and a supplemental contract April 20, 1895, as it was found by borings that some modification in the adopted plan would be required in order to insure the stability of the sewage reservoir.

At the close of the fiscal year 4,391 feet of 6 and 8-inch sewer pipe had been laid, 15 manholes built, and between 10 and 11 cubic yards of concrete and brick masonry put in place.

Amount appropriated by act of August 1, 1894		$37,500.00
Amount assessed on nonmilitary residents		22,432.50
Amount available of appropriation of August 1, 1894		22,432.50
		44,865.00
June 30, 1895, amount expended during fiscal year		3,898.10
July 1, 1895, balance unexpended		40,966.90
July 1, 1895, outstanding liabilities	$308.00	
July 1, 1895, amount covered by uncompleted contracts	35,398.00	
		35,706.00
July 1, 1895, balance available		5,260.90

(See Appendix No. 1.)

Water supply.—The supply of water is dependent upon rain water stored in cisterns and water of inferior quality pumped through iron pipes from across Mill Creek. An adequate supply of wholesome water within the limits of the fortification should be obtained, if possible. The act of February 24, 1891, appropriated $6,000 for an artesian well, but this amount is not deemed sufficient to sink a well to a depth thought necessary. A brief account of previous attempts at sinking artesian wells and a résumé of information collected during the fiscal year ending June 30, 1893, are given in Appendix 6 A of the report of the Chief of Engineers for that year. The local officer recommends an appropriation of $14,000 additional to the $6,000 already appropriated.

Wilmington, N. C.—Officer in charge, Maj. W. S. Stanton, Corps of Engineers, with First Lieut. Eugene W. Van C. Lucas, Corps of Engineers, as assistant; Division Engineer, Col. W. P. Craighill, Corps of Engineers, until May 10, 1895; Brig. Gen. W. P. Craighill, Chief of Engineers, from May 10 to 18, 1895, and Lieut. Col. P. C. Hains, Corps of Engineers, since the last-named date.

An allotment of $7,000 was made August 21, 1894, for the construction of a mining casemate and its gallery. Contracts have been made for the necessary material, and the work was commenced February 6, 1895. The casemate and gallery will be finished early in the ensuing fiscal year.

Charleston, S. C.—Officer in charge, Capt. F. V. Abbot, Corps of Engineers; Division Engineer, Col. W. P. Craighill, Corps of Engineers, until May 10, 1895; Brig. Gen. W. P. Craighill, Chief of Engineers, from May 10 to 18, 1895, and Lieut. Col. P. C. Hains, Corps of Engineers, since the last-named date.

A mining casemate required for this harbor is completed.

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An examination is being made into the question of a proper foundation for a lift battery for three 12-inch guns, for the construction of which a preliminary allotment of $75,500 has been made.

Savannah, Ga.—Officer in charge, Capt. O. M. Carter, Corps of Engineers; Division Engineer, Col. W. P. Craighill, Corps of Engineers, until May 10, 1895; Brig. Gen. W. P. Craighill, Chief of Engineers, from May 10 to 18, 1895, and Lieut. Col. P. C. Hains, Corps of Engineers, since the last-named date.

A mining casemate was completed during the past year.

Pensacola Harbor, Florida.—Officer in charge, Maj. F. A. Mahan, Corps of Engineers, with Second Lieut. Charles Keller, Corps of Engineers, as assistant until July 15, 1894, and Second Lieut. C. P. Echols, Corps of Engineers, assistant since that date; Division Engineer, Col. H. M. Robert, Corps of Engineers.

August 15, 1894, an allotment of $100,000 was made for commencing the construction of two emplacements of a battery for four 10-inch guns. A detailed survey of the site has been made, and working drawings and estimates of cost were well under way at the close of the fiscal year.

A mining casemate has been completed.

Mobile, Ala.—Officer in charge, Maj. A. N. Damrell, Corps of Engineers, with First Lieut. E. E. Winslow, Corps of Engineers, as assistant; Division Engineer, Col. H. M. Robert, Corps of Engineers.

An allotment of $50,000 was made March 9, 1895, with which to begin the construction of an emplacement for one 8-inch gun; and March 11, 1895, an allotment of $7,500 was made for the construction of a mining casemate. The preparation of plant and the repair of workshops and laborers' quarters were commenced in April. The first material was received in June, and both works are now under way.

New Orleans, La.—Officer in charge, Maj. J. B. Quinn, Corps of Engineers; Division Engineer, Col. H. M. Robert, Corps of Engineers.

The project for the defense of this place is under preparation, though a site and the plan for a battery of two 10-inch guns on disappearing carriages have been adopted.

March 8, 1895, $70,000 was allotted for commencing the construction of the emplacement for one of these guns, and drawings and specifications for this work are now in preparation.

San Francisco Harbor, California.—Officers in charge, Col. G. H. Mendell, with First Lieut. C. A. F. Flagler under his immediate orders until August 6, 1894, and First Lieut. J. E. Kuhn since that date, and Lieut Col. W. H. H. Benyaurd, with First Lieut. C. L. Potter under his immediate orders; all officers of the Corps of Engineers.

Four mining casemates have been completed. Colonel Mendell has charge of the construction of emplacements for three 10-inch guns on disappearing carriages, and for three 12-inch guns on nondisappearing carriages, and of a battery for sixteen 12-inch mortars.

One emplacement for a 12-inch gun and the platform are essentially completed, and the gun mounted. An ammunition hoist and conveyor are to be furnished, and the magazine and parapet to be covered with asphalt.

A second emplacement and its platform will be finished the coming fiscal year. The gun and carriage for this are on the ground. The construction of this platform awaits the testing of the platform already built, which is the first one of this class which has been constructed. It contains 220 cubic yards of concrete of the best quality, in which flat iron rails were placed radially and vertically. The horizontal layers are 2 feet apart vertically, and from 10 to 16 bars were laid in each

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layer. Discarded street cable of car lines was incorporated in the concrete in coils or horizontal planes about 2 feet apart. The lower portion of the platform was made polygonal in form, the portion above ground circular. Hold-down bolts are of aluminum bronze. The expenditures for the platform amounted to $2,518.43.

During the coming fiscal year the platforms for the three 10-inch guns on disappearing carriages will be built, and possibly the guns will be mounted.

Contracts have been let for ammunition conveyors for all of the six emplacements and for placing lifts in three.

The mortar battery is now finished, except for a system of ammunition conveyors, not yet determined. The 16 mortars are mounted, and all but one in condition for service. The remaining one will shortly be ready.

Lieutenant-Colonel Benyaurd reports, as to emplacements for three 12-inch guns on nondisappearing carriages, that under an allotment of $36,761.29 from the appropriation acts of August 1, 1894, and March 2, 1895, combined with balance from previous appropriation, work was commenced upon emplacement 5 at the Ridge Battery, at Lime Point, with the intention also of completing emplacements 3 and 4, all for 12-inch rifles on nondisappearing carriages. Ground was broken on March 26, and the excavation of so much of the ground as was then necessary was completed about the middle of May. The total amount of material excavated, consisting of loose rock, amounted to 4,870 cubic yards. The concrete work was commenced about the middle of June, and was well under way at the close of the fiscal year.

The three emplacements will be completed during the coming fall.

As to road from Sausalito to Lime Point, he reports as follows: Under an act of Congress approved July 2, 1894, the citizens of Sausalito were given the right of way over the reservation for the construction of a driveway. A survey was made, the line of road laid out, and the plans and specifications for construction were approved by the Secretary of War, and Lieutenant-Colonel Benyaurd was directed to supervise the work. To date nothing farther has been done.

The act approved August 1, 1894, appropriated $400,000 for the construction of gun and mortar batteries and $100,000 for the construction of platforms. The act of March 2, 1895, also appropriated the same amounts for the same purposes.

Part of the appropriations for gun and mortar batteries has been allotted to the completion of emplacements already commenced, but allotments have also been made for commencing new works, as follows:

One lift battery for three 12-inch guns, one emplacement for 12-inch, four for 10-inch, and two for 8-inch guns, and a battery for sixteen 12-inch mortars, for the defense of Portland, Me., New York, N. Y., Philadelphia, Pa., Hampton Roads, Va., Pensacola, Fla., Mobile, Ala., New Orleans, La., and San Francisco, Cal. Work is also in progress for testing the subfoundations of a proposed battery at Charleston, S. C.

The sum of $4,823.70 remains unallotted.

From the appropriations for platforms allotments have been made for the construction of platforms for one 12-inch gun, fifteen 10-inch guns, five 8-inch guns, and thirty-six 12-inch mortars, and for completing the construction of platforms for sixteen 12-inch mortars.

Thirty-four thousand seven hundred and fifty-eight dollars and eighty-eight cents remains unallotted at the date of this report, but this sum will be expended for platforms in emplacements now ready to receive them.

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PRESERVATION AND REPAIR OF FORTIFICATIONS.

An act approved March 2, 1895, appropriated the sum of $45,000 to be applied to the protection, preservation, and repair of fortifications for which there was no special appropriation. There are about 75 of these works, so that the amount appropriated averages about $600 per work.

Many of these works are in the charge of fort keepers or custodians whose salaries are paid from this appropriation; and, as authorized by law, part of the expenses of the clerical force of this office is to be defrayed from it. Hence so small an appropriation allows but few and, as a rule, only lesser repairs to be made to works. Extraordinary repairs, such as are required to meet damages occasioned by the numerous and severe storms of 1893 and 1894, can not be undertaken. Another demand upon these funds, that will increase from year to year, arises from the care required by the new emplacements as they are completed and provided with their armament.

The emplacements are more scattered, farther removed from garrisons of old works; their armament has more intricate mechanism. The result is that greater expense attends their preservation and repair.

The sum of $45,000 is not sufficient to meet these needs and the demands for allotments for current repairs, and therefore the larger estimate of $70,000.

Some of the more important works of protection and repair carried on during the past year were: Remodeling or repairing platforms of ten 8-inch converted rifles, one 10-inch and five 15-inch smoothbores, and one 12-inch mortar, used for target practice; rebuilding of bridges over the ditches of Fort St. Philip and Fort Barrancas; repair of brush jetties and breakwater at site of Fort Gaines; very extensive repairs to the breakwater at Fort Monroe, which had been washed out for some 60 feet or more, while the bank in rear had cut out from 10 to 40 feet, so that in case of other severe storms from the east there was great danger of the sea cutting through into the moat; the care of the completed lift battery of the defenses of New York, and overhauling the torpedo material for the defense of Portland, Me.

Many minor repairs were made, such as repairs of slopes, roofs, fences, magazine doors, postern gates, embrasure shutters, and wharves.

SITES FOR FORTIFICATIONS.

Portland Harbor, Maine.—The project for defense of this harbor contemplates the establishment of batteries on Cushings Island. The owners demanded more than was thought to be a reasonable price, and proceedings were brought for the condemnation of 33.4 acres of land as sites for batteries.

An award of $112,240 was made in December, 1893, and was accepted by the Government, and all payments were made early in June, 1893, except one item of $9,000. This item was not accepted by the owners of the property until August, 1894, as they have contemplated an appeal. The cost of this site was $112,423.60.

Narragansett Bay, Rhode Island.—Under instructions from this office, the officer in charge of the defenses of this bay made report August 25, 1894, as to the areas required for sites of modern batteries as located in the project for the defense of the bay. The areas amount to about 32 acres. Further report was received July 13, 1895, from which it is

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evident that resort to condemnation would be necessary, should the acquisition of these sites be authorized. Much of the land required is improved, and the greater part of the remainder is held at a comparatively high price, the prices, so far as set, footing up $338,500 for about 30.25 acres.

Fort Wadsworth, N. Y.—A survey of lands adjacent to Fort Wadsworth, N. Y., purchased for defensive purposes, was made and mapped, at a cost of $746.11.

By direction of the Secretary of War, 6½ acres, the property of Mrs. Sarah Schuyler Martin, adjacent to Fort Wadsworth, was purchased for $44,000 and interest at 6 per cent on said sum from June 26, 1891. The purchase was completed February 25, 1895, and payment made, amounting to $53,680.

Baltimore, Md.—A report has been made of the areas of three sites needed for batteries projected for the defense of this harbor, and January 4, 1895, the Chief of Engineers submitted to the Secretary of War a recommendation that these areas be acquired by condemnation, which has been approved by the Secretary of War, and proceedings will be instituted to secure the condemnation of the land.

Charleston, S. C.—The title to sites for three batteries projected on Sullivans Island has been granted to the United States conditionally by the State of South Carolina. The condition is that the grant shall not be effectual as to any portion of the premises described in which any person or persons have now any right, title, or interest, or upon which any person or persons now own or have any structures or improvements, until the United States of America shall have compensated such person or persons for such right, title and interest, and for such buildings, structures, and improvements, and acquired the title of such person or persons thereto; and until the United States of America shall have compensated certain other parties mentioned in the act making the grant. The act of the State legislature further provides for determining by a jury verdict the compensation to be paid, in case of no agreement being arrived at by the United States and the persons having interests, etc. The values of these rights, etc., as determined by the owners, and as appraised by a United States agent, have been received, and farther steps have been taken in the matter.

By act of Congress approved August 1, 1894, $150,000 was appropriated for the acquisition of sites for seacoast defenses. This sum will be almost entirely exhausted in the procurement of sites for defenses at Narragansett Bay, Baltimore Harbor, and Charleston Harbor, negotiations for which are now pending. An appropriation of $250,000 is requested for the procurement of sites for other projected works.

SEA WALLS AND EMBANKMENTS.

Sandy Hook, New Jersey.—A sea wall was completed in the summer of 1894. It is an extension to the westward of a wall which forms part of the project for the improvement of New York Harbor.

To stop excessive erosion then in progress authority was given to expend the sum of $2,000 from the appropriation for New York Harbor in protecting the beach.

The act of August 1, 1894, making appropriations for fortifications, etc., appropriated $7,500 for constructing a sea wall at this point. The wall was completed October 13, 1894, at a total cost of $7,298.03. It is 1,130 feet long, with a jetty 120 feet long; the section of wall and

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jetty is 13 feet at base by 7 feet in height. The total quantity of stone in the completed wall is 4,546 tons.

The protection thus afforded appears to be complete; the high-tide line has moved out in some places as much as 250 feet, and is uniform and regular.

Bedloes Island, New York.—Repairs to the sea wall of this island were made, the work being done by contract, at an expense of $1,749.18.

About 580 linear feet of new wall is required to complete the circuit of the island. The new wall would be of service and very much improve the appearance of the island. The cost of the new wall is $25,000, and an estimate therefor is submitted.

Davids Island, New York.—Repairs to the sea wall on the northeast side of the island are now about completed, about 540 cubic yards of stone having been placed behind the sea wall. An available balance of $183.88 of the allotment for this work will accomplish all that is required for this work.

Fort Schuyler, N. Y.—The sea wall at this work requires early action at various points; some portions have suffered considerably from heavy gales during last winter and spring. An estimate of $4,225 for this work is submitted.

Fort McHenry, Md.—Building a portion of the sea wall in rear of the cemetery, 227 feet long, was finished May 11, 1895. Work on a contract for completing the sea wall in rear of the site of the fort, about 808 feet long, is progressing satisfactorily, and is to be finished August 5, 1895.

ESTIMATES OF APPROPRIATIONS REQUIRED FOR 1896-97.

For construction of gun and mortar batteries	$1,815,000
For construction of gun and mortar platforms	70,000
For purchase of land for fortifications	250,000
For protection, preservation, and repair of fortifications	70,000
For preparation of plans for fortifications	5,000
For sea walls and embankments	29,225
For artesian well at Fort Monroe, Va	14,000
For purchase of submarine mines and necessary appliances to operate them for closing the channels leading to our principal seaports	50,000
For needful casemates, cable galleries, etc., from which to operate submarine mines	50,000
Total	2,353,225

THE BOARD OF ENGINEERS.

The following changes in the personnel of the Board have taken place since the date of the last annual report:

Col. C. B. Comstock, Corps of Engineers, was retired from active service by operation of law on February 3, 1895.

Lieut. Col. Peter C. Hains, Corps of Engineers, was designated a member of the Board by letter of the Chief of Engineers dated November 13, 1894, and was relieved by the operation of Special Orders, No. 19, headquarters Corps of Engineers, June 10, 1895.

Maj. Charles W. Raymond, Corps of Engineers, was designated a member of the Board by Special Orders, No. 19, headquarters Corps of Engineers, June 10, 1895.

As constituted at the close of the past fiscal year The Board of Engineers consisted of the following-named officers of the Corps of Engineers: Col. Henry L. Abbot, president, Col. Henry M. Robert, Lieut. Col. G. L. Gillespie, and Maj. Charles W. Raymond.

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Each Division Engineer is also a member when any subject relating to fortifications in his division is under consideration by the Board, and the Engineer Officers in charge of districts are associated with the Board as members thereof for the consideration of subjects relating to their respective districts, upon the recommendation of the president of the Board, when deemed expedient by the Chief of Engineers.

The Board has considered the various subjects referred to it during the past year by the Chief of Engineers, and the following is a brief summary of the reports rendered thereon:

1894, July 9 and December 11. On the purchase of site for a mortar battery at Fort Preble, Me.

July 30. On retention of certain military reservations in Puget Sound for defensive purposes.

July 30. On purchase of land on Cushings Island, Maine, for defensive purposes.

July 30. On changes proposed in typical mortar battery.

September 6. On plan of emplacement for guns and mortars at Fort Point, California.

October 6 and November 21. On land required for defenses on Staten Island, New York Harbor.

October 30. On retention of Fort Johnston Military Reservation, N. C., by the War Department.

December 1. On site for a military post at Magnolia Bluff, Washington.

December 1. On encroachments upon military reservation of Point Adams, mouth of the Columbia River.

December 21. On submarine mine defense of Pensacola, Fla.

1895, January 5. On retention of Pelican Spit, Galveston Harbor, for defensive purposes.

January 16. On artillery defense of San Diego Harbor, California.

January 16. On submarine mine defense of San Diego Harbor, California.

January 16. On submarine mine defense of the mouth of the Columbia River.

January 25. Report by General Abbot on the latest pattern of the Laflin & Rand magneto-electric igniting machine for use in artillery and especially in mortar firing.

February 2. Report by General Abbot on volley practice with mortars at Sandy Hook.

February 5. On submarine mine defense of Puget Sound.

February 16. Estimate for the preservation and repair of Fort Moultrie, S. C.

March 11 and 23. On platform and emplacement for 8-inch Crozier-Buffington disappearing carriage.

March 11. On mining casemate at Fort Morgan, Ala.

April 20. On artillery defense of the mouth of the Columbia River.

April 20. On demolition of earthwork at Fort Wayne, Mich.

April 25. On the need of Grays Harbor, Washington, for military purposes.

April 27. On platform and emplacement for 10-inch Crozier-Buffington disappearing carriage.

May 25. On the use of steel in place of aluminum bronze for bolts and washers in platform construction.

June 7. On the use of Coast Survey steamer to determine the current velocities in Richs Passage, Puget Sound.

June 12. On the artillery defense of Puget Sound.

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June 18. On changes proposed at Governors Island, New York Harbor, to accommodate a regiment of troops.

In the performance of its duties the Board, under the instructions of the Chief of Engineers, made a personal inspection of defensive sites at Forts St. Philip and Jackson, at the mouth of the Mississippi River, and in the harbor of Galveston, Tex.

In addition to their duties with The Board of Engineers the individual members of the Board have been engaged as follows during the fiscal year ending June 30, 1895:

1. Col. Henry L. Abbot, Corps of Engineers, the president of the Board, has continued as Division Engineer of the Northeast Division, as president of the Board to establish harbor lines for the harbor of New York and its adjacent waters, as a member of the Board of Ordnance and Fortification, and as president of a board for the examination of officers of the Corps of Engineers with a view to their promotion. He also served as president of a board of Engineer Officers to examine and report upon proposed docks at Squaw Island, Niagara River, and is president of a board of Engineer Officers to examine and report upon the extension of the outer breakwater at Buffalo, N. Y. Under instructions of the Chief of Engineers dated July 30, 1892, June 30, 1893, March 1, 1894, and June 8, 1895, he has inspected the engineering works in the charge of Col. Henry M. Robert and Lieut. Cols. G. L. Gillespie, Jared A. Smith, Samuel M. Mansfield, William R. King, and David P. Heap, Corps of Engineers, as well as those of the five district officers of the Northeast Division.

2. Col. Henry M. Robert, Corps of Engineers, has been the disbursing officer of the Board. He has conducted the various works of river and harbor improvements and of fortifications under his charge and has served as a member of the Board of Visitors to the U. S. Engineer School, as Division Engineer of the Southwest Division, as member of the Board for the establishment of harbor lines for New York Harbor, Philadelphia, and Stamford, Conn., and as a member of a board for the examination of officers of the Corps of Engineers with a view to their promotion. He is also charged with the supervision of rebuilding of the bridge across the Connecticut River between Hartford and East Hartford and the construction of a bridge across Norwalk Harbor (or River), Connecticut.

3. Lieut. Col. G. L. Gillespie, Corps of Engineers, in addition to conducting the various works of river and harbor improvement and of harbor defense with which he was charged during the year, has continued to serve as a member of the Board of Visitors to the U. S. Engineer School and as a member of the Harbor Line Board for the harbor of New York and its adjacent waters. He was the representative of the War Department at the Sixth Congress of Internal Navigation, held at The Hague, Netherlands, July 22 to 28, 1894; has served as member and president of the Mississippi River Commission since date of appointment, February 15, 1895, and has also served as a member of a board for the examination of officers of the Corps of Engineers with a view to their promotion.

4. Maj. Charles W. Raymond, Corps of Engineers, has conducted the various works of river and harbor improvement and of fortifications under his charge, and has served as senior member of a board to make investigations as to certain bridges in accordance with instructions of the Secretary of War, and as chairman of a board appointed by the President, agreeably to the act of Congress approved June 7, 1894,

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authorizing the New York and New Jersey Bridge companies to construct a bridge across the Hudson River, to recommend to the Secretary of War "what length of span, not less than 2,000 feet, would be safe and practicable for a railroad bridge to be constructed over said river." He is also a member of the Harbor Line boards for the harbor of New York and adjacent waters, and for the port of Philadelphia, Pa., and is charged with the supervision of the construction of a bridge across Delaware River at Philadelphia and of two bridges across Frankford Creek, Pennsylvania.

POST OF WILLETS POINT, N. Y.—U. S. ENGINEER SCHOOL—BATTALION OF ENGINEERS—ENGINEER DEPOT.

Officer in command, Lieut. Col. W. R. King, Corps of Engineers.

POST OF WILLETS POINT, N. Y.

At the close of the fiscal year the garrison consisted of 21 commissioned officers and 390 enlisted men, including officers and noncommissioned officers of the general staff, student officers, and enlisted men of the Hospital Corps. This is a loss of 2 officers, and a gain of 10 enlisted men in strength over last year's report.

U. S. ENGINEER SCHOOL.

During the year 2 engineer officers and 5 line officers completed the course, and 3 infantry officers, who have completed the laboratory duty, are still engaged in the practice work of planting and operating torpedoes, which will be completed October 1, 1895.

All have manifested intelligence and interest in the work and are entitled to certificates of proficiency in one or more of the branches they have been studying and practicing.

BATTALION OF ENGINEERS.

The legal strength of the Battalion of Engineers is 5 companies of 150 men each, with a sergeant-major and a quartermaster-sergeant, and is officered by details from the commissioned officers of the Corps.

The present strength is 19 officers and 470 enlisted men.

The authorized strength of Companies A, B, and C, which are stationed at Willets Point, is 133 men each, and of Company E, stationed at West Point, N. Y., 100 men.

The total losses from all causes during the year have been 152, and the total gain 154, making a net gain of 2 men.

The Battalion of Engineers has been employed during the year at engineer, pontoon, and torpedo drills, rifle practice, photography, and military signaling; and Company E, at West Point, has assisted in the instruction of cadets in military engineering and pontoon drill.

Of the five companies constituting the legal strength of the battalion, one company at present exists only on paper.

ENGINEER DEPOT.

The engineer depot is the repository of tools and materials for pontoon bridges, sieges, torpedo service, and instruments for surveys and astronomical work upon which the Corps of Engineers may be engaged.

Some additions have been made to the stock of pontoon materials, among which may be mentioned 28 pontoon boats complete, and those on hand have been overhauled and repaired when necessary.

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Surveying, astronomical, and electrical instruments have been repaired by enlisted men detailed for the purpose, and such new instruments as were needed for issue to officers in the field and on public works have been purchased in the usual manner.

As a precaution against loss by fire, the frame building in which a large quantity of bridge and pontoon materials are stored was provided with two brick fire walls.

Torpedo materials for the submarine mining defense of Washington, D. C., have been contracted for, and other torpedo materials required to complete the outfit at sundry points have been procured.

A shed has been built over the three new cable tanks and fitted out with traveling cranes for handling any size of drums of cable.

The balance of submarine mining cable due on both contracts has been delivered, tested, and accepted.

A three-cored cable was procured and laid between Forts Wadsworth and Hamilton, N. Y., and is now in use by the Board on Control of Artillery Fire.

Some valuable additions were made to the collection of engineer models and minor repairs made to depot buildings and machinery.

Suitable additions have been made to the library of the Engineer School by purchase of recent publications on military and civil engineering and kindred scientific subjects.

There will be required for the fiscal year ending June 30, 1897, for the Engineer Depot at Willets Point, N. Y., the following, viz:

1. For incidental expenses of depot	$5,000.00
2. For purchase of materials for instruction of battalion	1,000.00
3. For purchase and repair of instruments	3,000.00
4. For purchase and binding of professional works for library of the U. S. Engineer School	500.00
Total	9,500.00

(See Appendix No. 3.)

RIVER AND HARBOR IMPROVEMENTS.

The funds with which the works for the improvement of rivers and harbors were prosecuted during the last fiscal year were derived from the appropriations by the river and harbor act of August 17, 1894, and appropriations in the sundry civil acts approved August 18, 1894, and March 2, 1895, for certain works on account of which contracts were to be made for completion as provided in the acts of September 19, 1890, and July 13, 1892, and such balances of former appropriations as were available.

A brief statement derived from the reports of the officers in charge of the several works hereinafter given sets forth the condition of each improvement, the extent of work performed during the last fiscal year, the amount expended, and estimate of amount required for its completion.

Experience has demonstrated the great economy, in every respect, in carrying on works of improvement under continuous contracts for which appropriations have been made in sundry civil acts, and it is judged that under that system the works will be completed in less than one-half the time which would be required were they to depend on biennial appropriations and a consequent succession of small contracts. There would thus be not only much economy of money, but the improvements would be very much sooner available for their intended use.

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In submitting the estimates for river and harbor works the ideas had in mind have been the following:

1. The laws require report to be made annually of the amount estimated to be necessary *for the completion* of each work for which Congress has made appropriation, and how much can be "profitably expended in the next fiscal year" *on approved projects.*

2. It has come to be the custom for Congress to pass no general river and harbor bill at the short sessions, so that the sum appropriated each alternate year is really intended to cover work for two fiscal years instead of one, as the estimates state.

3. While economy and business-like procedure would justify asking in many cases for the appropriation at once for expenditure as rapidly as possible of the sum needed for completion, the total for all the works in the United States would be very large and it has never been asked for.

4. Congress has never in a river and harbor law granted as much money as has been asked by the Chief of Engineers.

5. In the amounts now presented regard has been had to several circumstances, as follows:

(*a*) The estimates of the local engineers.
(*b*) The actual expenditures for *two* fiscal years.
(*c*) The appropriations in the law of August, 1894.
(*d*) The balances available August 31, 1895.
(*e*) The condition of the Treasury.
(*f*) The relative importance of the works.

Attention is invited to the following statement:

Total expended during year ending June 30, 1894 (exclusive of expenditures by Mississippi and Missouri River Commissions)	$15,463,089.28
Total expended during year ending June 30, 1895 (exclusive of expenditures by Mississippi and Missouri River Commissions)	15,440,994.97
Total as above for the two years	30,904,084.25
Total of estimates by local engineers for fiscal year 1897 (exclusive of estimates of Mississippi and Missouri River Commissions)	48,837,027.00
Total amount appropriated by river and harbor act of August 17, 1894	11,643,180.00
Total amount appropriated for rivers and harbors by sundry civil acts of August 18, 1894, and March 2, 1895	19,842,115.00
Total for the three acts	31,485,295.00
Total balance available (unpledged) of all previous appropriations for river and harbor improvement August 31, 1895	12,686,880.59
Total estimate submitted by Chief of Engineers for expenditure in two years	21,016,197.00
(This estimate is made up as follows: For general improvement, $12,356,600; for continuing contract works, $5,044,597, this for expenditure in one year; for the Mississippi River Commission, $2,665,000; for the Missouri River Commission, $750,000; for examinations, surveys, and contingencies, $200,000.)	
Special estimates submitted by the Mississippi River Commission	1,417,000.00
Special estimates submitted by the Missouri River Commission	160,000.00

The estimates submitted by the Chief of Engineers are only for works for which plans have been approved by Congress and appropriations previously made, and the amount in each case has been carefully considered, in the expectation *that it would not be reduced or scaled down if any appropriation be made.*

Section 2 of the river and harbor act approved March 2, 1867, requires that there shall be annually submitted to Congress a full estimate of the entire and permanent completion of each river and harbor work and of the amount that can be profitably expended on each uncompleted work in the next fiscal year.

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Reports are appended of the work accomplished in the removal of wrecks obstructing or endangering navigation, as provided for in section 4 of the river and harbor act approved June 14, 1880, and enlarged by provision in the river and harbor act of August 2, 1882.

Under the authority given to the Secretary of War in section 12 of the river and harbor act approved September 19, 1890, harbor lines have been established at the following localities: Rockland Harbor, Maine; New Haven Harbor, Connecticut; Milford Harbor, Connecticut; East River in the vicinity of Rikers Island, New York; Pittsburg Harbor, Pennsylvania; St. Louis Bay and around Grassy Point, Minnesota and Wisconsin, and along St. Louis River above Grassy Point as far as Spirit Lake; Milwaukee River between Cherry and Walnut streets, Milwaukee, Wis.; Fox River along the river fronts of the cities of Green Bay and Fort Howard, Wis., from the mouth upstream about 3.2 miles; Lake St. Clair from the lower end of Grossepoint to Milk River, Michigan; Cleveland Harbor, Ohio; Fairport Harbor, Ohio; Buffalo Harbor, New York; Niagara River at Buffalo, N. Y.; Wilmington Harbor, California; Puget Sound in front of the cities of Seattle and Ballard, Wash., and Hoquiam Harbor, Washington.

Examinations were made, whenever required by the committees of Congress, of bills authorizing the construction of bridges upon which the views of the War Department were desired. Of the bills so examined 22 originated in the Senate and 26 in the House of Representatives.

During the fiscal year examinations were made of such plans and locations as were submitted by parties interested of bridges proposed to be built over navigable waters subject to the approval of the Secretary of War, as authorized by acts of Congress. A brief statement is given of the action had in such cases.

Under sections 4 and 5 of the river and harbor act approved September 19, 1890, persons, corporations, or associations owning or controlling bridges over navigable waterways of the United States which are unreasonable obstructions to the free navigation of such waters, after being given a reasonable opportunity to be heard, have been notified to so alter the bridges as to render navigation through or under them reasonably free, easy, and unobstructed. In each case the changes required to be made were specified in the notice and reasonable time was prescribed in which to make them. A detailed statement of the cases is given further on in this report.

Reports made in compliance with the requirements of section 2 of the river and harbor act of July 5, 1884, and section 4 of that of August 5, 1886, of instances in which piers, breakwaters, or other works built by the United States in aid of commerce or navigation are used, occupied, or injured by a corporation or an individual will be found in Appendix Z Z.

The engineering works in the charge of this office are arranged in five divisions and officers of the Corps assigned as division engineers to overlook the works, as follows:

West of the Rocky Mountains: Pacific Division, Col. George H. Mendell. East of the Rocky Mountains: Northeast Division, Col. Henry L. Abbot; Southeast Division, Col. William P. Craighill and Lieut Col. Peter C. Hains; Southwest Division, Col. Cyrus B. Comstock and Col. Henry M. Robert; Northwest Division, Col. Orlando M. Poe.

South Pass of the Mississippi River.—During the fiscal year ending June 30, 1895, the legal channel was maintained at the head of the pass and through the pass itself; but during a period of forty-three days such channel was not maintained through the jetties.

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Survey of canal routes from Lake Erie to the Ohio River.—The river and harbor act of August 17, 1894, provides:

That the Secretary of War is hereby authorized and directed to appoint a board of three engineers of the Army, whose duty it shall be to survey the Miami and Erie Canal, the Ohio Canal and such branches thereof, and such river and stream channels as may in their judgment form available portions of a continuous canal connecting the waters of Lake Erie with the Ohio River through the State of Ohio, and to report as to the feasibility and advisability of improving and widening such canal to seventy feet at the water line and deepening the same to seven feet, and by construction of new locks not less than one hundred and fifty feet in length and twenty-one feet in width, with a capacity for vessels of at least two hundred and eighty tons burden, and to report to the next session of Congress with detailed plans and an estimate of the cost of such improvements. * * *

The joint resolution approved December 24, 1894, granted the Board an extension of time for making the survey and authorized the report to be made at the first session of the Fifty-fourth Congress instead of the third session of the Fifty-third Congress.

The Board, consisting of Col. O. M. Poe, Lieut. Col. Amos Stickney, and Maj. W. L. Marshall, Corps of Engineers, with Lieut. H. M. Chittenden, Corps of Engineers, as executive and disbursing officer, are now engaged upon the work.

ATLANTIC COAST AND GULF OF MEXICO.

IMPROVEMENT OF RIVERS AND HARBORS IN MAINE AND NEW HAMPSHIRE.

This district was in the charge of Lieut. Col. Peter C. Hains, Corps of Engineers, to November 5, 1894, and of Lieut. Col. D. P. Heap, Corps of Engineers, since that date; Division Engineer, Col. H. L. Abbot, Corps of Engineers, from December 18, 1894, to June 8, 1895.

1. St. Croix River, Maine.—An examination and survey of the St. Croix River were made under the provisions of the river and harbor act of August 11, 1888, and the reports on same were published in the Annual Report of the Chief of Engineers for 1890 (p. 463). The available depth, at mean low water, over the shoals, was found to be from 6.5 to 9.5 feet, and in the upper part of the harbor at Calais but 1.5 feet. The channel was also narrow. In the report on the survey it was proposed to obtain a channel 12 feet deep at mean low tide, with a general width of 200 feet, but narrowed to 150 feet and 100 feet at the upper end. Such an improvement would enable steamboats to reach landings at the upper end of the harbor, and would allow large lumber vessels to fully load at the wharves, instead of having to drop downstream about 4 miles to complete their cargoes.

An appropriation of $35,000 was made by act approved September 19, 1890, coupled with the proviso, "that the Government of the Dominion of Canada shall expend a like sum in the improvement of said river."

No work has yet been done pending action by the Dominion Government, and none of the appropriation has been expended.

By a provision in the river and harbor act of August 17, 1894, the Secretary of War was authorized, in his discretion, to expend the funds available for the St. Croix on the work of improving Lubec Channel, Maine.

July 1, 1894, balance unexpended	$35,000.00
August 17, 1894, balance authorized to be expended for improving Lubec Channel	35,000.00
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	280,000.00

(See Appendix A 1.)

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2. Lubec Channel, Maine.—This channel lies between the eastern extremity of the State of Maine and Campobello Island, Dominion of Canada.

Originally the channel was but 5 feet in depth at mean low tide, and but 2 feet at low water of spring tides.

The project, adopted in 1879, and subsequently modified, was for a channel 275 feet wide, 300 feet wide in the bends, and 12 feet deep at mean low tide.

At the close of the fiscal year 1891 this project had been practically completed, and no work has been done since.

The expenditures to June 30, 1894, amounted to $168,954.68.

The expenditures during the fiscal year just ended were $44.91, making the total expenditures $168,999.59. No work was done during the year.

The river and harbor act of September 19, 1890, ordered an examination of Lubec Channel, the report on which was published in the Annual Report of the Chief of Engineers for 1891 (p. 616). A new project was therein submitted for a channel having a least width of 500 feet and a depth of 12 feet at mean low tide. This project was adopted by the act of August 17, 1894, by which $5,000 was appropriated, and an unexpended balance of $35,000 for improving St. Croix River was made available for Lubec Channel. The estimated cost of the new project is $150,000. A contract for dredging, the first work under the new project, has been made, and the work will be commenced during the present season.

July 1, 1894, balance unexpended		$45.32
Amount appropriated by act of August 17, 1894		*40,000.00
		40,045.32
June 30, 1895, amount expended during fiscal year		44.91
July 1, 1895, balance unexpended		40,000.41
July 1, 1895, outstanding liabilities	$25.00	
July 1, 1895, amount covered by uncompleted contracts	37,200.00	
		37,225.00
July 1, 1895, balance available		2,775.41
Amount (estimated) required for completion of existing project		110,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		40,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix A 2.)

3. Moosabec Bar, Maine.—Before the improvement was commenced the entrance at the eastern end of Moosabec Reach was difficult, the channel being crooked, with ledges on either hand. The direct entrance was obstructed by a bar, on which the depth was only about 6 feet at mean low tide.

The project, adopted in 1881, provided for a channel 14 feet deep at mean low tide and not less than 200 feet wide through the bar at the eastern entrance to the reach. In 1888 the project was extended to provide for widening the 14-foot channel to 300 feet, for removal of ledges obstructing the channel, and for the construction of a small breakwater to divert cross currents.

The expenditures to June 30, 1894, were $75,432.01. At that date the 300-foot channel had been completed to the full projected width and depth, the breakwater had been built, and 1,047 cubic yards of ledge had been removed.

* Includes $35,000 transferred from St. Croix River.

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The expenditures during the past year amounted to $6,913.34.

The operations consisted in continuing the removal of ledge in the western approach to the dredged channel. A contract for removing about 700 cubic yards of ledge is about completed, and operations under another, covering about 400 cubic yards, will be in progress during the present season.

The benefits derived from the improvement are not local, the thoroughfare being extensively used by coastwise vessels, both as a harbor of refuge and as a sheltered route.

July 1, 1894, balance unexpended		$9,567.99
Amount appropriated by act of August 17, 1894		6,000.00
		15,567.99
June 30, 1895, amount expended during fiscal year		6,913.34
July 1, 1895, balance unexpended		8,654.65
July 1, 1895, outstanding liabilities	$825.76	
July 1, 1895, amount covered by uncompleted contracts	7,367.50	
		8,193.26
July 1, 1895, balance available		461.39
Amount (estimated) required for completion of existing project		59,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		15,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix A 3.)

4. Narraguagus River, Maine.—The obstruction to navigation consisted in a bar at the mouth of the river, over which there was a navigable depth of less than 6 feet at mean low tide and less than 4 feet at extreme low tide.

The project for improvement is to dredge a channel not less than 200 feet wide, having 11 feet depth at mean low tide from the deep water of the bay to Long Point, and a depth of 9 feet thence to the anchorage.

The expenditures to June 30, 1894, amounted to $27,559.40. At that date there had been dredged an 11-foot channel from the deep water in the bay in toward the new steamboat wharf 90 feet wide, with a space in front of the wharf 300 feet wide. From the new steamboat wharf to the old one near Long Point the channel was 100 feet wide, with a turning basin in front of the old wharf 300 feet wide.

The expenditures during the fiscal year ending June 30, 1895, amounted to $26.18. No work was in progress during the year. A contract for dredging to the extent of about 90,000 cubic yards in widening and extending the channel has been made, the work to be done during the present season.

July 1, 1894, balance unexpended		$7,440.60
Amount appropriated by act of August 17, 1894		5,000.00
		12,440.60
June 30, 1895, amount expended during fiscal year		26.18
July 1, 1895, balance unexpended		12,414.42
July 1, 1895, amount covered by uncompleted contracts		11,430.00
July 1, 1895, balance available		984.42
Amount (estimated) required for completion of existing project		10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix A 4.)

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5. Breakwater from Mount Desert to Porcupine Island, Bar Harbor, Maine.—The anchorage in front of the town of Bar Harbor, as well as the wharves at which steamers land, is exposed to storms and seas from southerly directions, at times rendering the anchorage insecure and the landing of passengers and freight at the wharves difficult.

The original project was to construct a riprap breakwater in a direct line from Porcupine Island to Dry Ledge, and thence to within a short distance of Mount Desert Island. The direction of that portion west of Dry Ledge was afterwards slightly changed, so that the westerly end of the breakwater would be somewhat farther to the southward. In January, 1893, the project was again amended, and now provides for a breakwater on the direct line first proposed, but somewhat shorter, terminating at a distance of about 600 feet from the low-water line on Mount Desert Island, reducing the estimated cost to somewhat more than one-half that of the project of 1890, but answering all needful requirements.

The expenditures up to the close of the fiscal year ending June 30, 1894, amounted to $101,070.52. That part of the breakwater between Porcupine Island and Dry Ledge had been completed, and about 400 feet of the breakwater west of Dry Ledge had been completed to full section.

The expenditures during the fiscal year ending June 30, 1895, were $48,678.12, making the total expenditures $149,748.64.

At the close of the fiscal year 1894 work was in progress under a contract which was completed about the middle of the following September. At that date the breakwater had been completed to a point 535 feet westward from Dry Ledge. A new contract was made in March, 1895, for continuing the work under the appropriation of 1894, and work was in progress at the close of the fiscal year. About 15,000 tons of stone will be deposited under this contract.

July 1, 1894, balance unexpended		$48,929.48
Amount appropriated by act of August 17, 1894		10,000.00
		58,929.48
June 30, 1895, amount expended during fiscal year		48,678.12
July 1, 1895, balance unexpended		10,251.36
July 1, 1895, outstanding liabilities	$466.55	
July 1, 1895, amount covered by uncompleted contracts	8,804.52	
		9,271.07
July 1, 1895, balance available		980.29

Amount (estimated) required for completion of existing project	260,200.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix A 5.)

6. Bagaduce River, Maine.—The Bagaduce is a small stream that empties into Penobscot Bay at Castine, Me. The upper part of the river divides into two branches, one called Northern Bay and the other South Bay. Northern Bay, near South Penobscot, is a shoal sheet of water of about 700 acres area, the bottom of which for the greater part is bare at low tide. There was a narrow channel from Bridges Point to Bowdens Wharf, which had a depth of less than 2 feet, and was obstructed by ledges and bowlders near Winslows Island. The South Bay is obstructed by ledges at Johnsons Narrows. A project for the improvement of the Northern Bay was adopted in 1890, which has for

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its object the securing of a channel 100 feet wide and 6 feet deep at mean low tide from Bridges Point to Bowdens Wharf, at an estimated cost of $45,000. It is also intended to remove a small quantity of rock obstructing the southern channel at Johnsons Narrows, at an estimated cost of $1,875.

The expenditures to the close of the fiscal year ending June 30, 1894, amounted to $12,000. At that date the channel had been dredged its entire length for a width of 40 feet, but the full projected depth had not been obtained throughout.

The expenditures during the year ending June 30, 1895, were $4,795.09, making the total expenditures $16,795.09.

The operations consisted in removing bowlders from the channel at Winslows Island, where it was shoalest. About 1,150 tons of bowlders was removed, increasing the depth at that locality to about 2 feet at mean low tide.

Amount appropriated by act of August 17, 1894	$5,000.00
July 30, 1895, amount expended during fiscal year	4,795.09
July 1, 1895, balance unexpended	204.91
July 1, 1895, outstanding liabilities	200.00
July 1, 1895, balance available	4.91
Amount (estimated) required for completion of existing project	29,875.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix A 6.)

7. *Penobscot River, Maine.*—The improvement of the Penobscot River was first undertaken in 1870, the project being for a channel not less than 150 feet wide, 12 feet deep at low tide, as far up as Bangor. At that time the channel was shoal and dangerous.

At Bangor the depth did not exceed about 6 feet at lowest stages, and navigation was obstructed by numerous rocks and ledges. The work was continued until 1880, and included also the removal of obstructions in the harbor at Bangor and at Bucksport, the expenditures aggregating $198,000. No further work was done until 1884, when a project was adopted for widening the channel at Bangor, and for certain improvements in the river below near Crosbys Narrows, at an estimated cost of $75,000. While this work was in progress a survey was made, under the river and harbor act of 1886, from Bangor to Bucksport Narrows, and a project was submitted for securing a 22-foot depth between Bucksport and Winterport, at an estimated cost of $365,000, making the combined cost of the two projects $440,000. The act of September 19, 1890, appropriated $25,000, and provided for dredging near Sterns Mill.

Another survey was ordered by the act of September 19, 1890, which was made, and the report published in the Annual Report of the Chief of Engineers for 1892 (pp. 533–540).

The general project under which the improvement of the Penobscot River is now being carried on may be stated as follows: To widen the channel at Bangor to 360 feet and a depth of 11 feet at extreme low tide; to widen, straighten, and deepen the channel near Crosbys Narrows and near Sterns Mill to a depth of 12 feet at extreme low tide, and to secure a channel depth of 22 feet at mean low tide between Bucksport and Winterport, the estimated cost of the entire work being $440,000.

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This estimate includes the cost of jetties at Frankfort Flats and High Head, in order to contract the waterway should contraction be necessary. It is thought, however, that as the deposit of sawdust and mill waste into the river has in a large measure been stopped, and as the channels at these places were obstructed chiefly by this material, the contraction works may not be necessary. The channel at Frankfort Flats was dredged in 1890 to 22 feet. Subsequently it filled up on the sides to some extent, the full depth in mid-channel being maintained. A recent survey showed that it had scoured out again, and that there existed a navigable channel not less than 500 feet wide and 22 feet or more in depth at low tide. As this is all the project aims at, no further works of any kind are needed at Frankfort Flats.

The channel at High Head, which had been deepened in 1891 from natural causes, subsequently filled up to some extent, so that it became advisable to dredge a channel the full depth and width called for by the project. This was done during the season of 1894, and it is thought that the channel may maintain its depth and render further work at that locality unnecessary.

Under the circumstances no appropriation is asked for the Penobscot River.

The appropriations up to the close of the fiscal year ending June 30, 1894, aggregated $348,300, and the expenditures under the various projects to the same date amounted to $319,264.77. The results were the widening and deepening of the channel at Bangor from a depth of 6 feet at extreme low tide to 11 feet, for a width of 360 feet; the dredging of the shoal at Sterns Mill to 12 feet and of the shoal just below Sterns Mill to the same depth; the removal of rocks, ledges, and other obstructions; the removal of a shoal near Bucksport, and a general increase in depth and width of channels from the mouth up to Bangor.

The expenditures during the fiscal year ending June 30, 1895, amounted to $18,496,80.

The operations consisted in dredging to 22 feet at mean low tide at High Head, and in redredging at Bangor where the channel had shoaled. The work was done under contract, and was completed in November, 1894.

July 1, 1894, balance unexpended	$29,035.23
June 30, 1895, amount expended during fiscal year	18,496.80
July 1, 1895, balance unexpended	10,538.43
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	290,000.00

(See Appendix A 7.)

8. *Belfast Harbor, Maine.*—Originally the harbor was not deep enough to accommodate the commerce. At one place the depth was only about 4 feet at mean low tide.

In 1876 a project for dredging was adopted, and the work was completed in 1879, at a cost of $22,000. No more work was done until 1890, when a new project was adopted by which it was proposed to dredge a channel 250 to 300 feet wide, and 15 feet deep at mean low tide, from the deep water at the entrance to the upper harbor; to dredge an area on the north side of the harbor to a depth of 8 feet, and to dredge an area on the south side of the channel to a depth of 13 feet.

The total expenditures up to June 30, 1894, were $45,000. At that date the 8-foot dredging had been completed, and the channel of entrance

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had been dredged to the full depth of 15 feet for a width of 125 to 225 feet.

The expenditures during the last fiscal year were $2,360.54.

The operations consisted in dredging the channel of entrance and the area on the south side of the channel. At the close of the year the condition of the work was as follows: The dredging of the 8-foot area and of the channel of entrance had been completed, and a portion of the area on the south side of the channel had been dredged.

Amount appropriated by act of August 17, 1894		$8,000.00
June 30, 1895, amount expended during fiscal year		2,360.54
July 1, 1895, balance unexpended		5,639.46
July 1, 1895, outstanding liabilities	$498.17	
July 1, 1895, amount covered by uncompleted contracts	4,893.31	
		5,391.48
July 1, 1895, balance available		247.98
Amount (estimated) required for completion of existing project		24,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix A 8.)

9. Camden Harbor, Maine.—Before the improvement was commenced vessels drawing more than 6 feet could not reach the wharves at low tide.

The improvement projected is to dredge an area at the eastern part of the entrance to a depth of 12 feet at mean low tide; to dredge a channel on each side of the harbor, and the approach to the same, to a depth of 10 feet at mean low tide; to dredge small channels at the upper end of the harbor to a depth of 5 feet at mean low tide; and after the completion of the above, to dredge the middle ground of the harbor to the same depths as the adjacent channels.

The expenditures under the present project, to the close of the fiscal year ending June 30, 1894, were $22,976.21. As a result the dredging of the western channel, of the approach, and of the area near the Boston steamboat wharf had been completed, and about 400 feet of the 10-foot channel on the eastern side of the harbor had been dredged.

The expenditures during the last fiscal year were $17.50. No work was done, but a contract has been made under which it is proposed to complete the dredging of the channels and to remove so much of the middle ground as the funds will permit. The work is to be done during the present season.

July 1, 1894, balance unexpended		$23.79
Amount appropriated by act of August 17, 1894		12,000.00
		12,023.79
June 30, 1895, amount expended during fiscal year		17.50
July 1, 1895, balance unexpended		12,006.29
July 1, 1895, outstanding liabilities	$50.00	
July 1, 1895, amount covered by uncompleted contracts	10,780.00	
		10,830.00
July 1, 1895, balance available		1,176.29
Amount (estimated) required for completion of existing project		25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		12,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix A 9.)

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10. Rockland Harbor, Maine.—The location of Rockland Harbor is such that, besides accommodating its own commerce, it affords a convenient refuge for large numbers of coasting vessels. When the project for a breakwater was adopted the harbor was open to easterly storms, the anchorage was unsafe, and the seas often broke over the wharves.

The project, as originally adopted in 1881, provided for two breakwaters, one starting from Southwest Ledge in the harbor and running in a northerly direction toward Jameson Point, a distance of 2,640 feet, the other starting from Jameson Point and extending southward about 1,900 feet. The estimated cost was $550,000. The top of each breakwater was to be only 5 feet above the level of mean low tide.

In 1887 the project was amended, so as to bring the top of the breakwater from Jameson Point to the level of high tide, leaving the other as originally designed. The estimated cost was thus increased to $650,000.

In 1890 the project was again modified. Instead of building the second breakwater from Southwest Ledge in a northerly direction, on which no work had been done, it was decided to prolong the one from Jameson Point in a southerly direction. By doing so a much larger area of the harbor would secure protection. The estimated cost of the new project was $632,500, this being inclusive of the part already constructed.

Up to the close of the fiscal year ending June 30, 1894, there had been expended on the breakwater the sum of $218,995.50, and about 234,110 tons of stone had been placed in position, practically completing the work to a point 2,451 feet from the shore.

The above expenditures had resulted in protecting a part of the harbor, giving a secure harbor of refuge for many vessels that trade near this port.

During the fiscal year ending June 30, 1895, the expenditures were $8,920.30.

In March, 1895, a contract was made for continuing the construction under the appropriation of 1894. Work was commenced April 1, 1895, and has been in progress since, extending the breakwater about 150 feet. The contract, which covers about 50,000 tons of stone, is to be completed during the present season.

One thousand dollars of the amount appropriated by act of August 17, 1894, was available for expenditure in completing a survey of the harbor. The field work of this survey was about finished during June, 1895.

July 1, 1894, balance unexpended		$1,004.50
Amount appropriated by act of August 17, 1894		30,000.00
		31,004.50
June 30, 1895, amount expended during fiscal year		8,920.30
July 1, 1895, balance unexpended		22,084.20
July 1, 1895, outstanding liabilities	$1,689.32	
July 1, 1895, amount covered by uncompleted contracts	19,100.76	
		20,790.08
July 1, 1895, balance available		1,294.12

Amount (estimated) required for completion of existing project..... 382,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897 30,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix A 10.)

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11. Kennebec River, Maine.—Before the improvements were commenced the main channel of the river between the foot of Swan Island and Gardiner was obstructed by shoals near Beef Rock, with only 10 feet of water at mean low tide, by dangerous sunken ledges in Lovejoy Narrows, by a shoal below South Gardiner, with only 8 feet on it at mean low tide, and by a ledge at Nehumkeg Island. The steamboat channel to the west of Swan Island (at Hatchs Rock) was obstructed by a shoal over which there was only 7½ feet of water, and the channel between Gardiner and Augusta, a distance of 6½ miles, was obstructed by shoals which gave only a navigable depth of 3½ feet of water in low summer tide.

Appropriations were made at various times between 1827 and 1852 for improving the river, but the first regular project was adopted in 1866, and was for removing rocks and straightening and deepening the upper part of the river. The estimated cost was $50,000.

In 1868 the project was amended so as to give a wider channel, and the estimate was increased to $80,000. In 1871 the project was extended, the additional cost being estimated at $13,000, making the estimate for the entire project $93,000. It was again extended in 1872 to include the removal of ledges in Lovejoy Narrows, at an additional estimated cost of $30,603.61. This project was modified in 1873, and as modified was completed in 1877.

In 1881 a project was adopted for the improvement of the channel west of Swan Island and near the north end of it. The estimated cost of this project, which was completed in 1883, was $20,500.

The river and harbor act of 1886 provided for a new survey of the river from Bath to Augusta. This survey was made in 1887, and a project submitted for the further improvement of the river, giving 12 feet clear depth at low tide up to the Upper Sands Bar, near South Gardiner, 10 feet thence to Hinckley Shoal, and 8 feet thence to Augusta, together with an improvement of the steamboat channel west of Swan Island to 9 feet at mean low tide. The estimated cost of this project was $410,500, which estimate was subsequently increased to $428,500.

In August, 1892, the project was revised and a general project for the improvement adopted, as follows: For a channel depth of 13 feet up as far as Sands Island; 12 feet thence to Hinckley Shoal, and 10 feet thence to Augusta; a steamboat channel 9 feet deep west of Swan Island, and the removal of old bridge piers at Hallowell, all the above depths being referred to mean low tide. The estimated cost of the revised project is $388,500.

The total expenditures for the river up to June 30, 1894, were $358,969.17.

The following work had been accomplished: The channel near Beef Rock had been improved to give a clear depth of over 12 feet, and a training wall completed. The dangerous rocks in Lovejoy Narrows had been removed to a depth of 12 feet and the channel straightened. Channels had been dredged to 12 feet at mean low tide through Upper Sands Bar, Gardiner Shoal, Browns Island Shoal, and Hinckley Lower Shoal, and to 10 feet through Hinckley Upper Shoal; thence to Augusta, about 3½ miles, the channel had been deepened to about 7 feet, though some shoaling had since taken place.

The ledge at Nehumkeg Island had been removed to 12 feet, the steamboat channel west of Swan Island had been deepened to 9 feet, and near the head of the channel to 10 feet, and the old piers of the bridge at Hallowell had been removed. A jetty about 1,500 feet long had been built at Upper Sands Bar.

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The expenditures for the year ending June 30, 1895, have been $12,958.80.

At the date of the last Annual Report the only work in progress was under a contract for removing ledge at Lovejoy Narrows. Operations were continued until November 16, when they were suspended for the winter. At the date of suspension about 1,488 cubic yards had been taken out, and the work done had been of material benefit to navigation. Work under this contract was resumed in May, 1895, to be completed during the present working season.

April 1, 1895, a contract was made for redredging at Beef Rock where some shoaling had taken place, for removing a small shoal near Independendent Ice Company's ice house, and for dredging to 10 feet at mean low tide through Hallowell, Shepards Point, and Britts Shoals, which will give 10 feet to within about one-half mile of Augusta. The contractors began about the middle of May, 1895, and had the work in progress at the close of the fiscal year. It is to be completed during the present working season.

March 27, 1895, a contract was made for the ledge excavation at Lovejoy Narrows not already under contract. Work was commenced in May last, to be completed during the present season.

July 1, 1894, balance unexpended		$36,380.83
Amount appropriated by act of August 17, 1894		50,000.00
		86,380.83
June 30, 1895, amount expended during fiscal year		12,958.80
July 1, 1895, balance unexpended		73,422.03
July 1, 1895, outstanding liabilities	$2,270.41	
July 1, 1895, amount covered by uncompleted contracts	59,849.17	
		62,119.58
July 1, 1895, balance available		11,302.45
Amount (estimated) required for completion of existing project		113,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		40,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix A 11.)

12. Harraseeket River, Maine.—Under the act approved March 3, 1881, a survey of Harraseeket River was made in July of that year, and a report was submitted by the engineer of the district in December.

The river empties into Casco Bay at Stockbridges Point, about 12 miles northeast of Portland. From Stockbridges Point up to Westons Point the depth of water is no less than 10 feet at mean low tide, with no obstruction to navigation.

From Westons Point up to Freeport Landing, a distance of 4,500 feet, the depth diminished so that for the greater part of the distance the bottom of the river was 3½ feet out of water at mean low tide. The rise and fall of tides here is 9 feet. The project recommended in 1881 was the dredging of a channel not less than 60 feet wide and 3 feet deep at mean low tide up to Freeport, and a turning basin 180 feet wide at the head of the channel. The estimated cost of the improvement recommended was $13,000.

No appropriation was made for the work, however, and a new survey was ordered in the river and harbor act of 1888. A project for the improvement was submitted January 4, 1889. This project was on a somewhat larger scale than the one previously suggested, and contemplated a depth of channel of 5 feet at mean low tide, which would give

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about 14 feet at high tide. Work under this latter project, for which $26,000 had been appropriated, was in progress when, by act of August 17, 1894, Congress made an additional appropriation of $5,000 to complete the improvement. The project was then amended to include a central cut to a depth of 8 feet at mean low tide.

The estimated cost of the project as amended is $31,000—the sum of the three appropriations.

The expenditures to the close of the fiscal year ending June 30, 1894, were $717. At that date work was in progress under a contract for doing all the 5-foot dredging covered by the project, having been commenced in June of that year.

The expenditures during the year ending June 30, 1895, were $16,122.86, making the total expenditures $16,839.86. Dredging was continued until November 29, 1894, when work was suspended for the winter. At that date 93,932 cubic yards of material had been removed, giving a channel 90 feet wide, 5 feet deep at mean low tide, from the entrance to the basin at Freeport. Work was resumed in May, 1895, and was in progress at the close of the year.

A contract has been made for doing the 8-foot dredging, the work to be done during the present season. It was in progress at the close of the year.

It is expected to complete the project during the present working season, giving a channel 90 feet wide, 5 feet deep at mean low tide, with a central cut about 70 feet wide and 8 feet deep.

July 1, 1894, balance unexpended		$25,283.00
Amount appropriated by act of August 17, 1894		5,000.00
		30,283.00
June 30, 1895, amount expended during fiscal year		16,122.86
July 1, 1895, balance unexpended		14,160.14
July 1, 1895, outstanding liabilities	$1,843.82	
July 1, 1895, amount covered by uncompleted contracts	11,561.90	
		13,405.72
July 1, 1895, balance available		754.42

(See Appendix A 12.)

13. Portland Harbor, Maine.—The entrance to the main part of the harbor of Portland or the anchorage has always been good, but prior to the improvements made by the Government the approach to the inner harbor was obstructed by a shoal known as the middle ground, over which the depth was only from 8 to 10 feet at mean low tide, while between it and Stamford Ledge the greatest available depth was only 16 feet. Besides, the best part of the wharf front of the city was exposed to the swell from the Atlantic, which sometimes made it dangerous for vessels to lie at the docks, and the depth along this front was in some places as little as 4 feet, making a part of it unavailable for commercial purposes.

The first work of improvement undertaken by the Government was the construction of the breakwater. This was begun as early as 1836. It was completed in 1874.

The project for the improvement of the harbor by deepening its waters was first undertaken by authority of act of Congress of 1868. The project was at that time to excavate a channel 300 feet wide through the southern slope of the middle ground to a depth of 20 feet at mean low tide and the removal of the bar off the Grand Trunk wharves to the same depth.

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In 1870 the project was amended so as to provide for a channel 400 feet wide, and in 1871 it was again amended so as to provide for a width of 500 feet.

In 1872 the improvement of Back Cove was added to the project, and in December of that year the project was further amended by providing for the dredging of the inner harbor up to the harbor commissioner's lines to a depth of 16 feet. By 1876 all the contemplated improvements had been executed except some dredging in the inner harbor.

In 1881 Congress made an appropriation for the further improvement of the harbor, and a project was adopted looking to the entire removal of the shoal known as the middle ground, at an estimated cost of $160,000. The project was completed in 1885.

In 1886 the Board of Trade of Portland asked for the further improvement of the harbor to a depth of 29 feet at low tide, and in 1886 this project was adopted, the estimated cost being $135,000. In 1890 this project was extended to include a small quantity of dredging in the upper harbor, estimated to cost $5,000, making the total estimated cost of the project $140,000.

In 1894 it was again extended to cover the widening of the upper end of the 29-foot channel, and the dredging of a 25-foot channel to connect the deep water in the lower part of the harbor with that in the upper part, but without addition to the estimated cost.

The total amount expended on the harbor up to June 30, 1894, inclusive of all works of improvement was $551,721.65.

These expenditures resulted in giving, by means of the breakwater, partial protection to vessels at the lower wharves, and, by means of dredging, an available depth to navigation of 29 feet at mean low tide—a depth sufficient to accommodate the largest class of ocean steamers.

The expenditures during the year ending June 30, 1895, have been $24,755.40. The operations consisted in widening the upper end of the 29-foot channel and in dredging a 25-foot channel to connect the deep water in the lower part of the harbor with the deep water above.

The work was completed about the last of November, 1894.

The project is completed.

July 1, 1894, balance unexpended	$24,755.40
June 30, 1895, amount expended during fiscal year	24,755.40

(See Appendix A 13.)

14. Channel in Back Cove, Portland, Me.—Before any work was done toward improving Back Cove there existed no channel properly considered as such. Only the rudiments of an old channel existed, and for the most part even this was nearly dry at low tide.

The first project, adopted in 1872, had for its object the dredging of a channel 100 feet wide and 8 feet deep at mean low tide, from Tukey's Bridge to the "stone-shed wharves." The estimated cost was $15,000. The project was completed in 1874.

A survey was made in 1886 and a new project adopted having in view the widening of the channel to 300 feet and deepening it to 12 feet at mean low tide, with a turning basin at the upper end. The estimated cost was $180,000. This project is now in process of execution.

The expenditures under the existing project to the close of the fiscal year ending June 30, 1894, amounted to $76,535.13. At that date the channel had been extended for a distance of about 1,400 feet to a width of 160 feet; about 1,400 feet to a width of 265 feet, and the remaining length to a width of 90 feet, with a turning basin 400 feet wide at the upper end, all to the depth of 12 feet at mean low tide.

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The expenditures during the fiscal year ending June 30, 1895, were $22,616.27. The operations consisted in widening the channel by dredging. Work was commenced early in July, 1894, under contract, and was completed early in the following November, when 129,000 cubic yards of material had been excavated and removed.

In the meantime a contract had been made for continuing the dredging, under the appropriation of 1894. Work was commenced November 8, 1894, and continued until the 28th of the same month, when operations were suspended for the winter. Dredging was resumed early in May, 1895, and was in progress at the close of the fiscal year. The condition of the work is as follows: The channel has been dredged to its full width for about one-half its length, and to a width of about 180 feet for the remaining length, all to the depth of 12 feet at mean low tide. A turning basin 400 feet wide has been dredged.

July 1, 1894, balance unexpended		$19,714.87
Amount appropriated by act of August 17, 1894		20,000.00
		39,714.87
June 30, 1895, amount expended during fiscal year		22,616.27
July 1, 1895, balance unexpended		17,098.60
July 1, 1895, outstanding liabilities	$530.00	
July 1, 1895, amount covered by uncompleted contracts	16,500.00	
		17,030.00
July 1, 1895, balance available		68.60
Amount (estimated) required for completion of existing project		63,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		20,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix A 14.)

15. Saco River, Maine.—The first work done on the Saco River was in 1827, when an appropriation was made for the erection of piers, placing beacons or buoys, and removing obstructions. Prior to this the depth of water on the bar was only about 2 feet at mean low tide, while much of the river was deeper. The entrance was also dangerous in rough weather, and the numerous projecting rocks and ledges in the river proper, in connection with the swift currents, made its navigation dangerous.

In 1866 a plan was proposed for the improvement of the mouth of the river, and a project adopted in 1867. The project was for the construction of a breakwater at the mouth of the river, the removal of sunken rocks, and the rebuilding of some of the most important piers, against which vessels might drift without damage. The project was completed in 1878 at a cost of $169,275.

Nothing more was done on the Saco until 1883, when a resurvey of the breakwater was made and a new project submitted for raising and repairing it, and extending it out to Sharps Ledge.

The river and harbor act of 1884 directed a survey to be made of the river. This was done in 1885, and a project submitted for the improvement of the river proper from its mouth to the head of navigation. In 1886 and 1888 appropriations were made for repairing and raising the breakwater, and for improving the river. In 1890 the two projects were combined, so that the one now in process of execution is for improving the Saco River, including the breakwater, and the construction of a jetty opposite the same.

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The total expenditures on both river and breakwater up to June 30, 1894, were $307,061.82, and resulted in removing the dangerous ledges, in constructing piers to prevent vessels from being swept on the rocks, in constructing a substantial breakwater on the north side of the entrance, and the construction of a jetty on the south side of the entrance to contract the channel way with a view to obtaining a greater depth over the bar; also in deepening the channel in the upper portion of the river by dredging and the construction of contraction works.

The expenditures during the fiscal year ending June 30, 1895, were $13,950.39.

During July and August, 1894, the channels at Factory Island and at and near Cow Island were dredged under a contract, making the full depth of 6 feet at mean low tide.

In March, 1895, a contract was made for raising the places in the jetty where it had settled and for raising the shore end of the breakwater, or north jetty, to full section. The contractor commenced late in April, 1895, and the work was in progress at the close of the fiscal year.

The channel through the bar at the mouth of the river has deepened since the construction of the jetty, and it is expected that the depth will be maintained.

July 1, 1894, balance unexpended		$14,713.18
Amount appropriated by act of August 17, 1894		10,000.00
		24,713.18
June 30, 1895, amount expended during fiscal year		13,950.39
July 1, 1895, balance unexpended		10,762.79
July 1, 1895, outstanding liabilities	$464.29	
July 1, 1895, amount covered by uncompleted contracts	6,357.15	
		6,821.44
July 1, 1895, balance available		3,941.35
Amount (estimated) required for completion of existing project		62,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix A 15.)

16. Bellamy River, New Hampshire.—A survey was made of the Bellamy River in 1887, and a project of improvement suggested, at an estimated cost of $28,000, subsequently increased in 1891 to $35,000.

The project is to secure a channel 50 feet wide and 5 feet deep at mean low tide from the mouth of the river up to Sawyer's mill, at Dover. The rise and fall of the tide being about 7 feet, a high-water navigation of 12 feet will be secured.

The above project was adopted in 1888 and its execution is now in progress.

The expenditures up to the close of the fiscal year ending June 30, 1894, have been $19,681.61. These expenditures have resulted in giving a channel from the mouth of the river up to about 1 mile above Robert's brickyard 50 feet wide and 5 feet deep at low tide. In other words, about 1 mile was added to the navigable part of the river.

The expenditures during the fiscal year ending June 30, 1895, were $11.60.

No work was in progress, but a contract for dredging the upper part of the river has been made, the work to be done during the present season.

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July 1, 1894, balance unexpended		$7,818.39
Amount appropriated by act of August 17, 1894		7,500.00
		15,318.39
June 30, 1895, amount expended during fiscal year		11.60
July 1, 1895, balance unexpended		15,306.79
July 1, 1895, outstanding liabilities	$50.00	
July 1, 1895, amount covered by uncompleted contracts	13,800.00	
		13,850.00
July 1, 1895, balance available		1,456.79

(See Appendix A 16.)

17. Cocheco River, New Hampshire.—Before the improvement was begun the river from Dover to the Lower Narrows was much obstructed by bowlders, ledges, and shoals, the depth being in some places as little as 6 inches at mean low tide. The tide here rises and falls about 7 feet.

The first regular project for improvement was adopted in 1871, and looked to the forming of a channel 40 feet wide and 4 feet deep from the Lower Narrows up to Collin's Wharf. The estimated cost was $45,000. Subsequently more accurate and extended surveys having shown the practicability and importance of extending the improvements up to the head of navigation, the project was extended and the estimate increased to $85,000. This project was completed by 1879. The improvements had opened up a large commerce, employing large vessels where formerly only flatboats had been used, in consequence of which the project was still further extended by providing for a "cut-off" through Alleys Point, widening to 60 feet and deepening to 5 feet the existing channels through Trickeys and Clements Point shoals, and blasting and removing other obstructions. The extended project was completed in 1888.

In 1889 a new survey was made, in compliance with the requirements of the river and harbor act of August, 1888, and as the large increase of trade seemed to justify still further improvement of the river, a new project was submitted, looking to obtaining a depth of 7 feet, increased to 7½ in rock, and a width of 50 feet in rock and 60 to 75 where the material is less expensive to remove. This project was adopted in 1890, and is estimated to cost $175,000.

The expenditures up to June 30, 1894, have been $195,018.68. These have resulted in giving a channel through the rocky bed of the river 5 feet deep at low tide and 40 feet wide in the narrowest parts. The upper end of the channel in front of the wharves at Dover has been deepened to 7 feet at mean low tide for a length of 1,200 feet, with widths varying from 100 to 140 feet. Portions of the channel above and below Clement's Wharf, of a total length of 600 feet, have also been dredged to the same depth.

The expenditures during the fiscal year ending June 30, 1895, have been $14,099.09.

The operations consisted in removing ledge at Upper Narrows. A contract, which was in progress during the working season of 1894, was completed early in December, when 2,078.86 cubic yards had been removed, completing about 350 feet of the channel at that locality to the full projected width and depth.

Another contract was made for continuing the ledge excavation at Upper Narrows, under which it is expected to remove about 2,400 cubic yards of material, the work to be done during the present season. It is now in progress.

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The improvements in the navigation of the Cocheco have been of great benefit to the people of Dover and that vicinity.

July 1, 1894, balance unexpended		$14,981.32
Amount appropriated by act of August 17, 1894		15,000.00
		29,981.32
June 30, 1895, amount expended during fiscal year		14,099.09
July 1, 1895, balance unexpended		15,882.23
July 1, 1895, outstanding liabilities	$200.00	
July 1, 1895, amount covered by uncompleted contracts	14,880.00	
		15,080.00
July 1, 1895, balance available		802.23

Amount (estimated) required for completion of existing project	120,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	15,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix A 17.)

18. Harbor of refuge at Little Harbor, New Hampshire.—A survey was made of Little Harbor in 1882 and a plan of improvement proposed which looked to the opening of a channel of entrance to a depth of 9 feet at low tide and a width of 100 feet, together with a basin 300 feet by 700 feet, which was to be protected by a rubblestone breakwater. The estimated cost was $33,000. This project was approved in 1886, and its execution entered upon. In 1887 the project was enlarged, as the old one did not seem to meet the requirements of those interested. The enlarged project provided for the construction of two breakwaters, one on the north, the other on the south side of the entrance to the harbor, and the dredging of an anchorage about 49 acres in extent, in the protected area, to a depth of 12 feet at mean low tide. The estimated cost of the enlarged project was $235,000, and the act of 1888 made an appropriation for the work on the enlarged plan.

In October, 1894, after the breakwaters had been completed and a part of the dredging accomplished, the project was amended by reducing the area of the anchorage to be dredged to about 40 acres, instead of 49. At the same time the estimate was revised and the cost of the entire work placed at $145,000.

Before the improvement was begun the harbor was exposed to the full force of the sea in northeast gales, and the depth of water at the entrance and within the harbor was not sufficient to accommodate even small craft at low tide.

The total expenditures up to June 30, 1894, were $89,509.78. At that date the breakwater on the south side of the entrance had been completed, the construction of the breakwater on the north side of the entrance was in progress under contract, and a channel 300 feet wide, 9 feet deep at mean low tide for 100 feet of its width, and 12 feet deep for the remaining width, had been dredged.

The expenditures during the fiscal year ending June 30, 1895, were $9,231.34.

The operations consisted in the construction of the breakwater on the north side of the entrance, which was completed in October, 1894, and in continuing the dredging of the anchorage area, which was commenced early in June, 1895, and was in progress at the close of the fiscal year.

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July 1, 1894, balance unexpended		$10,490.22
Amount appropriated by act of August 17, 1894		10,000.00
		20,490.22
June 30, 1895, amount expended during fiscal year		9,231.34
July 1, 1895, balance unexpended		11,258.88
July 1, 1895, outstanding liabilities	$200.00	
July 1, 1895, amount covered by uncompleted contracts	10,000.00	
		10,200.00
July 1, 1895, balance available		1,058.88
Amount (estimated) required for completion of existing project		35,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix A 18.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH THE RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations and surveys of the following localities, required by the act of August 17, 1894, were made by the local engineers and reports submitted:

1. Preliminary examination of Glen Cove Harbor, Maine.—Lieut. Col. P. C. Hains, Corps of Engineers, submitted report of examination October 13, 1894. It is his opinion, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 47, Fifty-third Congress, third session. (See also Appendix A 19.)

2. Preliminary examination of Royals River, Maine.—Lieutenant-Colonel Hains submitted report of examination October 15, 1894. It is his opinion, concurred in by this office, that the locality is worthy of improvement by the General Government to the extent of giving a navigable depth of 7 feet at mean low tide, which corresponds to a high-tide depth of about 16 feet, and that the survey necessary for preparation of plan and estimate of improvement will cost $800. The report was transmitted to Congress and printed in House Ex. Doc. No. 20, Fifty-third Congress, third session. (See also Appendix A 20.)

3. Preliminary examination of Parkers Head Harbor and Channel, Maine.—Lieutenant-Colonel Hains submitted report of examination October 17, 1894. It is his opinion, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 21, Fifty-third Congress, third session. (See also Appendix A 21.)

4. Preliminary examination of Cape Porpoise Harbor, Maine.—Lieutenant-Colonel Hains submitted report of examination October 26, 1894. It is his opinion, concurred in by this office, that the locality is worthy of improvement. It is estimated that the necessary survey will cost $600. The report was transmitted to Congress and printed in House Ex. Doc. No. 22, Fifty-third Congress, third session. (See also Appendix A 22.)

5. Survey of Machias River Channel, Maine.—Lieut.-Col. D. P. Heap, Corps of Engineers, submitted report of survey January 9, 1895. He recommends that the channel be widened to 125 feet, with a depth of 7 feet at mean low water except at and above Middle Rock, at an estimated cost of $50,244.25. Lieutenant-Colonel Heap reports that he is informed, and circumstantial evidence shows, that sawdust, shingle

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refuse, etc., are still thrown in the stream, and that until the law is strictly enforced in this regard periodical dredging will be needed to maintain the requisite depth of channel; and the Division Engineer, Col. H. L. Abbot, Corps of Engineers, expresses the opinion that these deposits should cease before the work should be prosecuted by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 253, Fifty-third Congress, third session. (See also Appendix A 23.)

6. Survey of Carvers Harbor, Maine.—Lieutenant-Colonel Heap submitted report of survey February 2, 1895. He presents two plans for improvement, the first contemplating the construction of a breakwater from Lanes Island to Green Ledge and dredging a portion of the harbor to 10 feet at mean low tide, at an estimated cost of $69,500. The second plan proposes dredging to a depth of 16 feet, omitting the breakwater, at an estimated cost of $64,000. The former plan is preferred by Lieutenant-Colonel Heap as, in his opinion, much greater advantages will be obtained with slightly increased cost; but Colonel Abbot, the division engineer, is of the opinion that the cost of the projected breakwater can not safely be estimated at less than $1 per ton. The cost of the first plan of improvement on this basis will be $102,300. The report was transmitted to Congress and printed in House Ex. Doc. No. 304, Fifty-third Congress, third session. (See also Appendix A 24.)

7. Survey of Georges River, Maine.—Lieutenant-Colonel Heap submitted report of survey January 10, 1895. He reports that the best method of improvement for this stream is to deepen the present channel to 16 feet at mean low tide for a width of 90 to 220 feet, and to repair the beacon opposite Browns Point. The estimated cost of this work is $30,000. The report was transmitted to Congress and printed in House Ex. Doc. No. 236, Fifty-third Congress, third session. (See also Appendix A 25.)

8. Survey of Sasanoa River, Maine.—Lieutenant-Colonel Heap submitted report of survey December 13, 1894. He submits estimates amounting to $19,000 for securing a full 12-foot depth at mean low tide at Carletons Ledges, for widening the channel at Upper Hell Gate to 125 feet and to the same depth of 12 feet, and for constructing a beacon on the jetty at Camp Ground. The report was transmitted to Congress and printed in House Ex. Doc. No. 142, Fifty-third Congress, third session. (See also Appendix A 26.)

IMPROVEMENT OF RIVERS AND HARBORS IN EASTERN MASSACHUSETTS.

This district was in the charge of Lieut. Col. S. M. Mansfield, Corps of Engineers.

1. Newburyport Harbor, Massachusetts.—The object of the improvement is to create a channel through the outer bar 1,000 feet wide and with a least depth of 17 feet at mean low water, or 24½ feet at mean high water.

The project, adopted in 1880 and modified in 1883, is to build two converging rubblestone jetties, so located as to give a proper direction to the current, and thereby produce and maintain the desired result. The estimated cost of the project was $375,000.

The original depth of water on the bar was 7 feet at mean low water.

The total appropriations to date have been $297,500.

To June 30, 1894, $269,723.84 had been expended, and the north jetty was completed for a length of 2,705 feet. The south jetty was 1,300 feet long, of which 1,077 feet was completed.

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The Plum Island Dike was 817 feet long, 5½ feet high above mean low water, except near the center, where a weir 150 feet long and 2 feet above mean low water was left temporarily.

The sand catch in rear of the south jetty was in two branches, one 480 feet long and one 572 feet long.

On October 16, 1894, a contract was entered into to deposit 15,000 tons of rubblestone in the south jetty.

Operations under this contract were commenced in May, 1895, and 973 tons was deposited during the fiscal year.

At the date of this report the condition of the improvement is the same as on June 30, 1894.

July 1, 1894, balance unexpended		$7,776.16
Amount appropriated by act of August 17, 1894		20,000.00
		27,776.16
June 30, 1895, amount expended during fiscal year		7,571.52
July 1, 1895, balance unexpended		20,204.64
July 1, 1895, outstanding liabilities	$1,346.79	
July 1, 1895, amount covered by uncompleted contracts	17,253.21	
		18,600.00
July 1, 1895, balance available		1,604.64
Amount (estimated) required for completion of existing project		77,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix B 1.)

2. Merrimac River, Massachusetts.—The object of the improvement is to straighten, deepen, and widen the natural channel of the river from its mouth to the Upper Falls, a distance of 21½ miles.

The channel originally was narrow, crooked, and much obstructed by ledges, bowlders, and shoals; and below Newburyport by ledges, cribs, piers, and wrecks.

At mean low water vessels drawing not to exceed 7 feet could cross the bar and proceed about 6 miles above Newburyport.

The mean rise or fall of the tide at the mouth of the river is 7½ feet; at Haverhill bridge, 4 feet.

The project, originally adopted in 1870, proposed to remove obstructions from the Upper and Lower Falls, to remove Gangway Rock, to remove the wreck of the *Globe*, and to remove the "Boilers."

The cost was estimated at $69,025.

This project was revised and extended in 1874 to include the removal of rocks at Deer Island and Rock bridges and at Little Curriers Shoal, so that the channel should have the following depths at ordinary high-water stages of the river: From the mouth to Deer Island bridge (5 miles), 16½ feet; thence to Haverhill bridge (12½ miles), 12 feet; thence to the foot of Mitchells Falls (1½ miles), 10 feet; through Mitchells Falls to the head of the Upper Falls (2½ miles), not less than 4½ feet, with the mill water at Lawrence running. This revised project was estimated to cost $147,000.

The total appropriations to date have been $242,366.72.

The expenditures to June 30, 1894, were $237,055. At that date the project of improvement was completed.

In December, 1894, a survey of the river from the mouth up to Haverhill, provided for in the act of August 17, 1894, was commenced, and at the date of this report is well advanced toward completion.

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At the date of this report the improved channel is in good order.

July 1, 1894, balance unexpended	$5,311.72
June 30, 1895, amount expended during fiscal year	2,942.55
July 1, 1895, balance unexpended	2,369.17
July 1, 1895, outstanding liabilities	611.25
July 1, 1895, balance available	1,757.92

(See Appendix B 2.)

3. Powow River, Massachusetts.—Powow River is a tributary of the Merrimac River, into which it enters from the north about 3½ miles above Newburyport.

From its mouth tide water extends 9,600 feet in a narrow, crooked channel, not navigable at low water.

The project proposed for its improvement is to dredge a channel 9,600 feet long, 60 feet wide, and 12 feet deep at mean high water, at an estimated cost of $77.000.

The total appropriations to date have been $27,000.

No expenditures had been made to June 30, 1894.

On October 15, 1894, a contract was entered into to dredge 64,000 cubic yards from this river.

No operations were in progress under this contract during the year.

July 1, 1894, balance unexpended	$12,000.00
Amount appropriated by act of August 17, 1894	15,000.00
	27,000.00
June 30, 1895, amount expended during fiscal year	35.55
July 1, 1895, balance unexpended	26,964.45
July 1, 1895, amount covered by uncompleted contracts	24,960.00
July 1, 1895, balance available	2,004.45
Amount (estimated) required for completion of existing project	50,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	15,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3. 1893.	

(See Appendix B 3.)

4. Ipswich River, Massachusetts.—Ipswich River empties into Plum Island Sound about 9 miles south of Newburyport, Mass. It is navigable from its mouth to the wharves at Ipswich, a distance of 3 miles. Before improvement, at low water, not to exceed 1½ feet draft could be carried in a narrow channel.

The mean rise or fall of the tide is 8.4 feet.

The object of the improvement is to widen and deepen the natural channel of the river.

The original project was submitted in 1875. It proposed a channel 60 feet wide and 4 feet deep at mean low water.

In 1887 the project was modified by limiting the present improvement to opening a channel 60 feet wide and 4 feet deep through "The Shoals" and "Labor in Vain" and extending it to the "Deep Hole," opposite the town wharves.

The amount appropriated for this improvement to date is $7,500.

The amount expended to June 30, 1894, was $2,637.59.

On June 30, 1894, the improved channel was completed as proposed at "Labor in Vain," and at "The Shoals" it was 40 feet wide, of full depth. Operations were then in progress under a contract which was fulfilled in August, 1894. thereby completing the limited project.

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At the date of this report the improved channel is in good order.

July 1, 1894, balance unexpended	$4,862.41
June 30, 1895, amount expended during fiscal year	2,980.32
July 1, 1895, balance unexpended	1,882.09

(See Appendix B 4.)

5. Essex River, Massachusetts.—Essex River empties into Ipswich Bay, about 3 miles southeast of the mouth of Ipswich River, Massachusetts. It is navigable at high water to the wharves in the town of Essex, a distance of 6 miles, but no navigable low-water channel exists for 12,000 feet below the town wharves.

The mean rise or fall of the tide is 8.8 feet.

The object of the improvement is to widen and deepen the natural channel of the river.

The project for improvement was submitted May 15, 1891, and proposed a channel 60 feet wide and 4 feet deep at mean low water to the wharves at Essex, estimated to cost $25,000.

The total appropriations to date have been $10,000.

No expenditures had been made to June 30, 1894.

On October 15, 1894, a contract was entered into to dredge 47,000 cubic yards from the river.

Operations were immediately commenced, and during the fiscal year 12,736 cubic yards was removed under the contract. No appreciable benefit to navigation will be had until this contract is completed.

The prospective benefits to commerce are increased facilities and safety to navigation.

July 1, 1894, balance unexpended		$5,000.00
Amount appropriated by act of August 17, 1894		5,000.00
		10,000.00
June 30, 1895, amount expended during fiscal year		1,069.19
July 1, 1895, balance unexpended		8,930.81
July 1, 1895, outstanding liabilities	$1,700.39	
July 1, 1895, amount covered by uncompleted contracts	6,510.16	
		8,210.55
July 1, 1895, balance available		720.26
Amount (estimated) required for completion of existing project		15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		5,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix B 5.)

6. Harbor of Refuge, Sandy Bay, Cape Ann, Massachusetts.—This bay is situated at the northeastern extremity of Cape Ann, Massachusetts. It is open to the full effects of easterly and northeasterly gales.

The proposed improvement contemplates the construction of a national harbor of refuge of the first class. The anchorage covered by the breakwater will contain 1,377 acres.

The estimated cost of the improvement is $5,000,000. The original project of 1884 proposed to build only the substructure of the breakwater of rubblestone. The present project, approved March 17, 1892, proposes to build the entire breakwater of rubblestone.

The total appropriations to date have been $750,000.

The expenditures to June 30, 1894, not including outstanding liabilities, were $558,295.46.

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The condition of the improvement June 30, 1894, was as follows: 671,776 tons of stone had been deposited in the breakwater. Of this amount 661,828 tons was small stone (less than 4 tons' weight) deposited below low water, and 9,948 tons was large stone (averaging 6 tons' weight) deposited above mean low water. Four thousand six hundred feet of the breakwater was to a grade 22 feet below low water, of which 500 feet was completed and 100 feet to the grade of mean low water.

Operations were in progress under a contract to deposit 14,000 tons of large stone and 120,000 tons of small stone in the breakwater, and during the fiscal year 2,933 tons of small stone and 3,500 tons of large stone were deposited in the breakwater, completing the contract in August, 1894.

On October 15, 1894, a contract was entered into to deposit 240,000 tons of small stone in the substructure of the breakwater.

Operations were commenced under this contract in November, 1894, and during the fiscal year 5,313 tons of stone was deposited. At the date of this report a total of 683,522 tons of stone has been deposited in the breakwater, of which 13,448 tons is large stone, and 670,074 tons small stone.

The breakwater is completed for 600 feet, and to the grade of 22 feet below low water for a total distance of 4,600 feet.

The prospective benefits to commerce and navigation by the completion of this harbor of refuge are increased safety to life and property, and a consequent reduction in freights and insurance.

July 1, 1894, balance unexpended		$41,704.54
Amount appropriated by act of August 17, 1894		150,000.00
		191,704.54
June 30, 1895, amount expended during fiscal year		35,786.32
July 1, 1895, balance unexpended		155,918.22
July 1, 1895, outstanding liabilities	$2,534.10	
July 1, 1895, amount covered by uncompleted contracts	140,108.13	
		142,642.23
July 1, 1895, balance available		13,275.99
Amount (estimated) required for completion of existing project		4,250,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		150,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix B 6.)

7. Gloucester Harbor, Massachusetts.—Gloucester Harbor is an important center for the fishing fleet of New England, about 20 miles north of Boston. Its inner harbor was originally obstructed by sunken rocks and shoals, and the approaches to the wharves were shallow, varying from 1 to 12 feet. The outer harbor was open to all southerly gales.

The first project for its improvement was submitted January 20, 1871, and proposed to build a breakwater from Eastern Point to Round Rock Shoal, and to clear the harbor of sunken rocks.

The present approved project was submitted in 1887. It proposed to remove from the inner harbor obstructing rocks and shoals, giving in front of the wharves, as far as Pew's Wharf, 15 feet depth at low water,

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and 10 feet in Harbor Cove, and to build a breakwater from Eastern Point to Round Rock Shoal, in substantially the same location as that proposed in the project of 1871.

The total appropriations to date have been $120,000.

The expenditure to June 30, 1894, was $59,643.13, and at that date the condition of the improvement was as follows: Clam Rock, Pinnacle Rock, rock off J. Friend's Wharf, and rock off Pew's Wharf had been reduced to the level of the surrounding bottom, and Babsons Ledge to 14 feet below mean low water.

The dredging in the inner harbor and Harbor Cove was completed. Operations were then in progress under a contract for the removal of 549 cubic yards of ledge in the inner harbor. This contract was completed July 31, 1894.

Nothing had been done on the breakwater.

On October 16, 1894, a contract was entered into to deposit 57,000 tons of rubblestone in the breakwater.

Operations under this contract were commenced in November, 1894, and during the year 35,497 tons of stone was deposited in the breakwater, completing 400 feet of its substructure.

July 1, 1894, balance unexpended		$20,356.87
Amount appropriated by act of August 17, 1894		40,000.00
		60,356.87
June 30, 1895, amount expended during fiscal year		29,587.19
July 1, 1895, balance unexpended		30,769.68
July 1, 1895, outstanding liabilities	$7,416.94	
July 1, 1895, amount covered by uncompleted contracts	18,707.61	
		26,124.55
July 1, 1895, balance available		4,645.13

Amount (estimated) required for completion of existing project	712,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	40,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix B 7.)

8. *Manchester Harbor, Massachusetts.*—Manchester Harbor is situated about 5½ miles northeast from the entrance of Salem Harbor, Massachusetts.

The channel was 100 feet wide and 6½ feet deep at mean low water up to Proctors Point; it then shoaled rapidly to a depth of 1½ feet at the "Narrows"; 1,400 feet from Proctors Point and for a farther distance of 2,500 feet to the town wharves no low-water channel existed.

The project for its improvement proposed to dredge a channel from Proctors Point to the town wharves 60 feet wide and 4 feet deep at mean low water, at an estimated cost of $14,300.

The total appropriations to date have been $14,300.

The expenditures to June 30, 1894, were $14,139.29, and at that date the project of improvement was completed.

At the date of this report the improved channel is in good condition.

July 1, 1894, balance unexpended	$660.71
July 1, 1895, balance unexpended	660.71

(See Appendix B 8.)

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9. Salem Harbor, Massachusetts.—Salem Harbor is 12 miles northward of Boston, Mass. It contains a well-sheltered, entirely unobstructed anchorage of about 110 acres, more than 18 feet deep at mean low water.

The principal city wharves are located on South River, a small stream entering the harbor. This river was 3,000 feet long, from 150 to 300 feet wide, and not navigable at low tide.

The original project for the improvement of this harbor was submitted December 16, 1872. It proposed to dredge a channel of approach to the mouth of South River, 1,730 feet long, 300 feet wide, and 8 feet deep at mean low water. This project was essentially completed in 1873–1875.

The present project was submitted December 2, 1889. It proposed to clear out the channel as originally dredged, and to extend it to the head of navigation, gradually reducing its width from 150 feet at the mouth of the river to 100 feet near the inner end of Derby Wharf, and above this to excavate a channel 50 feet wide; to the inner end of Derby Wharf, the improved channel to be 8 feet deep at mean low water, and above this point 6 feet deep. The total length of the improved channel to be 5,100 feet approximately.

The total appropriations to date have been $53,000.

The expenditures to June 30, 1894, were $49,361.23, and at that date the project of improvement was completed.

During the fiscal year a survey of the harbor, provided for by the act of August 17, 1894, was completed, and a report under date of April 18, 1895, is submitted herewith as Appendix B 28.

At the date of this report the improvement is in good condition.

July 1, 1894, balance unexpended	$12,761.21
June 30, 1895, amount expended during fiscal year	12,113.37
July 1, 1895, balance unexpended	647.84

(See Appendix B 9.)

10. Lynn Harbor, Massachusetts.—Lynn Harbor is 9 miles northeast from Boston.

The original channels were narrow and crooked and had but 6 feet depth at mean low water.

The project for improvement was adopted in 1884. It proposed a channel 200 feet wide, 10 feet deep at mean low water, through the outer and inner bars. It is supposed that the inner channel will require occasional dredging, and a training wall was proposed, if required, to aid in keeping the outer channel open.

On September 24, 1884, it was proposed to extend the inner channel 400 feet within the harbor line and to excavate at its inner end an anchorage basin 500 by 300 feet in area, 10 feet deep at mean low water, at a cost of $25,000.

The estimated cost of the original project was $157,000.

The total appropriations to date have been $108,500.

The total expenditures to June 30, 1894, were $100,115.25.

At that date the outer channel and basin were completed; the inner channel was completed for 500 feet at its southerly end, and the remainder was 150 feet wide; the western or Saugus River channel was 4,000 feet long, 150 feet wide, 8 feet deep at mean low water.

On December 12, 1894, a contract was entered into to dredge 32,000 cubic yards from the inner channel.

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Operations under this contract were commenced during the latter part of June, 1895, and 7,020 cubic yards was dredged during the fiscal year.

July 1, 1894, balance unexpended		$884.75
Amount appropriated by act of August 17, 1894		7,500.00
		8,384.75
June 30, 1895, amount expended during fiscal year		20.75
July 1, 1895, balance unexpended		8,364.00
July 1, 1895, outstanding liabilities	$1,689.27	
July 1, 1895, amount covered by uncompleted contracts	5,745.40	
		7,434.67
July 1, 1895, balance available		929.33

Amount (estimated) required for completion of existing project	73,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	7,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix B 10.)

11. Winthrop Harbor, Massachusetts.—Winthrop Harbor is situated in the northeastern part of Boston Harbor. It contains 350 acres, approximately all of which is essentially dry at low tide. The mean range of tides is 9.4 feet.

The original project for its improvement proposed to dredge a straight channel 3,900 feet long, 50 feet wide, 6 feet deep at mean low water, from the "Back" channel of Boston Harbor to Rice's Wharf.

The total appropriations to date have been $9,000.

The expenditures to June 30, 1894, were $8,983.21, and the proposed improvement had been completed.

No operations were in progress during the fiscal year, and at the date of this report the improved channel is in good condition.

July 1, 1894, balance unexpended	$16.79
June 30, 1895, amount expended during fiscal year	9.38
July 1, 1895, balance unexpended	7.41

(See Appendix B 11.)

12. Mystic and Malden rivers, Massachusetts.—These two rivers empty into the inner harbor of Boston, Mass.

Malden River is tributary to the Mystic River, their junction being about 3 miles above the mouth of the latter.

Originally no low-water channel existed in either river.

A project for the improvement of Mystic River was submitted May 9, 1891. It proposed to widen and deepen the natural channel to the head of navigation in Medford, a distance of about 4½ miles, so that it should be 100 feet wide, 6 feet deep at mean low water to the first turn above Denning's wharf; thence 4 feet deep at mean low water, the width gradually contracting to 50 feet at the upper end; estimated to cost $25,000.

The original project for the improvement of Malden River was submitted December 1, 1880, and was modified in 1882. The modified project is to make the natural channel 100 feet wide, 12 feet deep at mean high water to the first bridge, and thence 75 feet wide to the second

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bridge, the estimated cost being $37,000. The mean range of tides is 9.8 feet.

Ten thousand dollars was appropriated for the improvement of Malden River in 1882, and expended in 1883–84 in accordance with the project, making a channel 50 feet wide, 12 feet deep at mean high water to the first bridge.

The act of July 13, 1892, appropriated $10,000 for the improvement of Mystic and Malden rivers. Five thousand dollars of this amount was retained in the Treasury for the improvement of Malden River (when additional funds should be available), and the balance was to be expended in improving Mystic River as proposed.

On August 8, 1892, an advertisement was issued calling for proposals for this work. The lowest bid received (48 cents per cubic yard) was rejected as excessive.

The act of August 17, 1894, appropriated $10,000 for the improvement of these rivers.

On October 16, 1894, a contract was entered into to dredge 75,000 cubic yards from Mystic and Malden rivers. Operations under this contract were commenced in May, 1895.

July 1, 1894, balance unexpended		$9,958.45
Amount appropriated by act of August 17, 1894		10,000.00
		19,958.45
June 30, 1895, amount expended during fiscal year		85.87
July 1, 1895, balance unexpended		19,872.58
July 1, 1895, outstanding liabilities	$2,742.01	
July 1, 1895, amount covered by uncompleted contracts	15,524.24	
		18,266.25
July 1, 1895, balance available		1,606.33

Amount (estimated) required for completion of existing project	40,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix B 12.)

13. Boston Harbor, Massachusetts.—The object of this improvement is, first, to preserve the harbor by protecting the islands and headlands; and, second, to improve it by widening, straightening, and deepening the channels.

The projects adopted for this purpose since 1866 have been mainly in accordance with the recommendations of the United States commissioners whose labors terminated during that year.

The works of preservation consist of sea walls, aprons, jetties, etc., which protect the shores of the islands and headlands, prevent additional wash into the channels, control tidal scour, and preserve the full height of anchorage shelter for vessels in the roadsteads. Such have been built or repaired at Point Allerton and the islands of Great Brewster, Lovells, Gallops, Long, Deer, Rainsford, Georges, and Castle.

The works of improvement have been by dredging and blasting, by which means many dangerous rocks and shoals have been removed and the main ship channel enlarged from 100 feet wide and 18 feet deep at mean low water, so that it is now at least 625 feet wide and 23 feet deep at mean low water.

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The following tributary channels have also been improved:

a. Charles River.—The natural channel of this river has been widened, straightened, and deepened, so that from its mouth to Western avenue bridge, a distance of 4¾ miles, the channel has a width of 200 feet and a depth of 7 feet at mean low water; thence to Arsenal street bridge, 2½ miles, the channel has a least width of 80 feet and a least depth of 6 feet.

b. Fort Point Channel.—This important branch of the main ship channel had a least depth of 12 feet at its entrance, and the channel was narrow and crooked. It has been widened to 175 feet and deepened to 23 feet at mean low water from its mouth to Congress street bridge, a distance of 1,900 feet.

c. Hingham Harbor.—See separate report.

d. Nantasket Beach Channel.—This channel was originally about 50 feet wide, 8 feet deep at mean low water. It is now 150 feet wide, 12 feet deep at mean low water.

e. Channel between Nixs Mate and Long Island.—This channel had originally 4½ feet depth at mean low water. A cut has been made through the bar 300 feet wide, 15 feet deep at mean low water.

f. Broad Sound.—An obstruction called Barrel Rock was removed in 1869.

g. Jeffreys Point Channel.—This channel is an extension of the main ship channel from near Grand Junction wharf (East Boston) toward Jeffreys Point. It is now 400 feet wide from Grand Junction wharf to just east of Simpson's patent dry docks, and 18 feet deep at mean low water, thence gradually narrowing the proposed channel to 250 feet, and decreasing the depth of water to 15 feet at mean low water to a junction with the same depth off Jeffreys Point.

The total expenditures to June 30, 1894, were $2,422,144.43.

On June 30, 1894, the upper main ship channel had been dredged under the project of 1867 to a depth of 23 feet at mean low water, 1,100 feet wide west of the Upper Middle, 1,000 feet wide at the Lower Middle; and the lower main ship channel had been dredged under the project of August 11, 1892, to a depth of 27 feet at mean low water, 300 feet wide at the shoal east of Nashs Rock, 1,000 feet wide at the shoal west of Nashs Rock, 500 feet wide at the Centurion Shoal, and 700 feet wide in the Narrows; but the free use of this 27-foot channel was restricted by ledges uncovered by the dredging.

A contract was in force for the removal of the ledge in the Nantasket Beach Channel, and operations were in progress under a contract for dredging in the lower main ship channel.

During the fiscal year the ledge in the Nantasket Beach Channel was removed.

The contract for dredging in the lower main ship channel was completed April 30, 1895.

On November 27, 1894, a contract was entered into to remove 8,772 cubic yards of ledge from the lower main ship channel.

Operations under this contract were commenced in May, 1895; but as during the fiscal year only 300 cubic yards was removed, no benefit has been obtained by these operations.

On April 10, 1895, a contract was entered into to dredge 150,000 cubic yards from the Narrows. Operations were commenced under this contract in April, 1895, and during the fiscal year 80,048 cubic yards was dredged.

At the date of this report the lower main ship channel is 27 feet deep at mean low water, 1,000 feet wide from the entrance to Bug Light,

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and 800 feet wide in the Narrows to the passage between Georges and Gallops islands. Elsewhere its condition is the same as on June 30, 1894.

July 1, 1894, balance unexpended		$182,131.67
Amount appropriated by act of August 17, 1894		200,000.00
		382,131.67
June 30, 1895, amount expended during fiscal year		141,512.70
July 1, 1895, balance unexpended		240,618.97
July 1, 1895, outstanding liabilities	$21,442.39	
July 1, 1895, amount covered by uncompleted contracts	164,848.93	
		186,291.32
July 1, 1895, balance available		54,327.65

Amount (estimated) required for completion of existing project	1,145,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	200,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix B 13.)

14. Weymouth River, Massachusetts.—Weymouth (Fore) River empties into the southwestern part of Boston Harbor, Massachusetts. For 4 miles it was navigable at low water for vessels drawing 18 feet, and to the head of navigation, an additional 3 miles, at least 3 feet depth was to be found.

The original project for its improvement was submitted December 2, 1889. It proposed to improve the natural channel so that 6 feet at mean low water could be carried to the head of navigation in a channel 100 feet wide to near Weymouth Landing, thence to Braintree bridge 80 feet wide, and above the bridge 50 feet wide; the total length of improved channel to be 7,000 feet, and to cost $40,000.

The total appropriations to date have been $25,000.

The expenditures to June 30, 1894, were $10,038.64. At that date the improved channel was 6 feet deep at mean low water, 40 feet wide to Braintree bridge, and 25 feet wide thence to the head of navigation.

The act of August 17, 1894, appropriated $5,000 for this river, "of which two thousand five hundred dollars shall be used in the improvement of Weymouth (Back) River."

On October 2, 1894, a contract was entered into to dredge 37,000 cubic yards from Weymouth River. Operations under this contract were commenced December 1, 1894, and during the fiscal year 18,528 cubic yards was dredged.

At the date of this report the improved channel is 6 feet deep at mean low water, 60 feet wide to within 3,000 feet of Braintree bridge, and above the bridge, 25 feet wide.

The project for the improvement of Weymouth (Back) River was submitted February 7, 1891. It proposed to dredge a channel through the outer bar 200 feet wide and 12 feet deep at mean low water, and to widen and deepen the natural channel of the river to the same dimensions, to the wharf of the fertilizer company, at an estimated cost of $22,000.

The expenditure of the $2,500 available would produce no appreciable benefit to commerce, and will be retained in the Treasury until additional funds are appropriated.

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July 1, 1894, balance unexpended		$9,961.36
Amount appropriated by act of August 17, 1894		5,000.00
		14,961.36
June 30, 1895, amount expended during fiscal year		5,709.77
July 1, 1895, balance unexpended		9,251.59
July 1, 1895, outstanding liabilities	$1,101.60	
July 1, 1895, amount covered by uncompleted contracts	5,356.88	
		6,458.48
July 1, 1895, balance available		2,793.11
Amount (estimated) required for completion of existing project		37,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix B 14.)

15. Hingham Harbor, Massachusetts.—The object of this improvement was to widen and deepen the natural channel, which was 30 feet wide and 4 feet deep, so that it would be 100 feet wide and 10 feet deep at mean low water.

The project was originally proposed in 1874 and was modified in 1885. The original project was estimated to cost $11,000. The project of 1885 was to cost an additional sum of $18,750.

The total appropriations to date have been $29,000.

The expenditures to June 30, 1894, were $29,000, and the project of improvement was completed.

No work has been done during the fiscal year, and at the date of this report the improved channel is in good condition.

The prospective benefits to commerce are increased facilities and safety to navigation.

(See Appendix B 15.)

16. Scituate Harbor, Massachusetts.—This harbor is on the west shore of Massachusetts Bay, about 14 miles south of Boston Light.

The object of the improvement is to create a harbor of refuge for vessels bound to Boston from the eastward which are too far south of their true course to clear the dangerous ledges near Minots Ledge Light.

Originally the harbor had a low-water area of about 57 acres, more than 6 acres of which had a depth of at least 3 feet at mean low water. It was entirely open to the force of easterly gales, and its entrance was obstructed by sunken bowlders.

The project adopted in 1880 is to build two breakwaters, one from Cedar Point, on the north side of the entrance, and the other from the first cliff, on the south side, and to dredge the area inclosed and in front of the entrance. The estimated cost of the improvement is $290,000.

The total appropriations to date have been $83,680.

The amount expended to June 30, 1894, was $73,635.79. At that date the north breakwater was essentially completed. The south breakwater was 300 feet in length. The anchorage basin was 350 by 400 feet in area, 7 feet deep at mean low water. The channel connecting the basin with the town wharves was 2,100 feet long, 100 feet wide, 3 feet deep at mean low water, and the entrance channel was 1,600 feet long, 100 feet wide, and 5 feet deep at mean low water.

On October 22, 1894, a contract was entered into to deposit 9,500 tons of rubblestone in the south breakwater. Operations under this

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contract were commenced in November, 1894, and during the fiscal year 3,823 tons of stone was deposited, making the south breakwater, 450 feet in length, completed. The condition of the north breakwater and dredged channels remains unchanged since June 30, 1894.

The prospective benefit to commerce is the creation of an additional harbor of refuge on this much frequented dangerous coast.

July 1, 1894, balance unexpended		$44.21
Amount appropriated by act of August 17, 1894		10,000.00
		10,044.21
June 30, 1895, amount expended during fiscal year		2,856.48
July 1, 1895, balance unexpended		7,187.73
July 1, 1895, outstanding liabilities	$1,461.61	
July 1, 1895, amount covered by uncompleted contracts	5,279.61	
		6,741.22
July 1, 1895, balance available		446.51
Amount (estimated) required for completion of existing project		207,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		6,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix B 16.)

17. Plymouth Harbor, Massachusetts.—Plymouth Harbor is 30 miles south of Boston. The object of its improvement is to perpetuate the harbor by the preservation of Long Beach, which forms it, and to deepen and widen the channels of approach to an enlarged anchorage basin in front of the town wharves.

The various devices employed for the preservation of Long Beach are described in the Annual Report of the Chief of Engineers for the year 1877.

The original project for improvement was adopted in 1875 and modified in 1877 and 1884. The modified project proposed an improved channel 2,286 feet long, 150 feet wide, and 9 feet deep at mean low water, leading to an anchorage basin 866 feet long, 150 feet wide, and 9 feet deep.

The total appropriations to date have been $181,266.90.

The expenditures to June 30, 1894, were:

For beach protection	$127,245.34
For dredging	50,514.89
Total	177,760.23

At that date the project for improvement had been completed and the works for the protection of Long Beach were in good order.

No operations were in progress during the fiscal year, and at the date of this report the works of protection and improvement are in good condition.

July 1, 1894, balance unexpended		$2,017.59
Amount appropriated by act of August 17, 1894		1,500.00
		3,517.59
June 30, 1895, amount expended during fiscal year		10.92
July 1, 1895, balance unexpended		3,506.67
Amount (estimated) required for completion of existing project		1,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		1,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix B 17.)

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18. Kingston Harbor, Massachusetts.—Kingston Harbor is one of the three divisions which together form Plymouth inner harbor.

The wharf at which supplies are landed for the town of Kingston is about 2 miles south of the center of the town and is known as the Plymouth Cordage Company's wharf. No low-water channel of navigable dimensions existed to this wharf.

The project for the improvement was submitted May 25, 1891. It proposed to dredge a channel 100 feet wide, 6 feet deep at mean low water, from deep water to the Cordage Company's wharf, at an estimated cost of $10,000.

The total appropriations to date have been $10,000.

The expenditures to June 30, 1894, were $8,940.09, and at that date the project had been completed.

No operations were in progress during the fiscal year, and at the date of this report the improved channel is in good order.

July 1, 1894, balance unexpended	$1,059.91
July 1, 1895, balance unexpended	1,059.91

(See Appendix B 18.)

19. Wellfleet Harbor, Massachusetts.—Wellfleet Harbor is 12 miles southeast of Provincetown, on Cape Cod Bay. Originally no low-water channel to the town wharves existed. The object of its improvement is to provide a navigable channel from the inner anchorage, the "Deep Hole," to the town wharves.

The original project was submitted in 1871 and the present approved project was submitted November 28, 1887. It proposed to dredge a channel from the "Deep Hole" to the town wharves 4,200 feet long, 100 feet wide, and 6 feet deep at mean low water.

The total appropriations to date have been $16,000. The expenditures to June 30, 1894, were $11,350.37, and at that date the channel proposed was 25 feet wide, 4 feet deep at mean low water. Two hundred and four cubic yards of sunken rock had been removed under the project of 1871.

No operations were in progress during the fiscal year, as the funds available are not sufficient to secure any appreciable benefit to commerce, and at the date of this report the condition of the improvement is the same as on June 30, 1894.

July 1, 1894, balance unexpended	$4,649.63
July 1, 1895, balance unexpended	4,649.63
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	22,000.00

(See Appendix B 19.)

20. Provincetown Harbor, Massachusetts.—Provincetown Harbor is situated at the extremity of Cape Cod, about 40 miles southeast from Boston Light. It is one of the most valuable harbors of refuge on the Atlantic Coast. The entire commerce of New England and a very large local fishing interest are directly benefited by its maintenance, which depends entirely on the preservation of the sandy beaches which inclose it.

Since 1826 the project has been a general one, and provides for the preservation of the harbor by building dikes, bulkheads, and sand catches, and extensive planting of beach grass to repair or prevent storm damages to the beaches.

The total appropriations to date have been $154,418.44.

The amount expended to June 30, 1894, was $147,677.49.

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During the fiscal year repairs were made to the bulkheads protecting Long Point near the Wood End Light and near Abel Hill Dike, and at the date of this report all the works of preservation are in good order.

July 1, 1894, balance unexpended	$5,240.95
Amount appropriated by act of August 17, 1894	1,500.00
	6,740.95
June 30, 1895, amount expended during fiscal year	2,169.28
July 1, 1895, balance unexpended	4,571.67
Amount (estimated) required for completion of existing project	1,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	1,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix B 20.)

21. Chatham Harbor, Massachusetts.—Chatham Harbor is at the eastern end of Nantucket Sound, about 15 miles east of Hyannis, Mass.

Its outer anchorage (Chatham Roads) is a valuable harbor of refuge from northerly and easterly gales. The inner harbor (Stage Harbor) is small, but well landlocked, and has 8 to 12 feet depth at mean low water. Its entrance was obstructed by three bars, on which the greatest depth at mean low water was 4 feet.

The project for the improvement of this harbor, submitted December 19, 1890, proposes to dredge a channel through the three obstructing bars 6 feet deep at mean low water—100 feet wide at the inner bar, 150 feet wide at the middle bar, and 200 feet wide at the outer bar—at a cost of $10,000.

The total appropriations to date have been $5,000.

The expenditures to June 30, 1894, were $4,402.15.

At that date the improved channel through the middle and inner bars was 100 feet wide, 6 feet deep at mean low water. Nothing had been done on the outer bar.

No operations were in progress during the fiscal year, and at the date of this report the condition of this improvement is the same as on June 30, 1894.

July 1, 1894, balance unexpended	$597.85
July 1, 1895, balance unexpended	597.85
Amount (estimated) required for completion of existing project	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

(See Appendix B 21.)

22. Removing sunken vessels or craft obstructing or endangering navigation.—Under the provisions of section 4 of the river and harbor act of 1880 the wreck of the schooner *Ocean Eagle*, sunk 2½ miles southeast of the entrance to Newburyport Harbor, Massachusetts, was removed in September, 1894, at a total cost of $172.70. (See Appendix B 22.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations and surveys of the following localities, required by the act of August 17, 1894, were made by the local engineer, Lieut. Col. S. M. Mansfield, Corps of Engineers, and reports thereon submitted:

1. Preliminary examination of Manchester Harbor, Massachusetts, from mouth of river below the Point of Rocks, with a view to a channel 100 feet wide and 5 feet deep, and removal of sand bar at mouth of river and removal of sand bar and rocks at the Point of Rocks.—Lieutenant-Colonel

Mansfield submitted report of examination October 29, 1894. It is his opinion, concurred in by this office, that the harbor is worthy of improvement to the extent of removing the obstructions at the mouth and at Point of Rocks and the dredging of the channel between them to 100 feet wide, with 5 feet depth. The necessary survey may be made for $300. The report was transmitted to Congress and printed in House Ex. Doc. No. 49, Fifty-third Congress, third session. (See also Appendix B 23.)

2. Preliminary examination of Plymouth Harbor, Massachusetts, with a view to the removal of the obstructions known as "Splitting Knife" and "Middle Ground," and the north and south sides of the excavated channel in said harbor, with a view to deepening and improving the same.—Lieutenant-Colonel Mansfield submitted report of examination October 29, 1894. He is of the opinion, concurred in by this office, that the harbor is worthy of additional improvement by the General Government to the extent of removing the "Middle Ground" obstructions and of the easterly end of "Splitting Knife," to ease the entrance to the dredged channel. The survey necessary for preparation of project and estimates may be made for $300. The report was transmitted to Congress and printed in House Ex. Doc. No. 50, Fifty-third Congress, third session. (See also Appendix B 24.)

3. Preliminary examination of Chatham New Harbor, Massachusetts.—Lieutenant-Colonel Mansfield submitted report of examination October 29, 1894. It is his opinion, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 69, Fifty-third Congress, third session. (See also Appendix B 25.)

4. Survey of Chelsea River, Massachusetts, from Grand Junction Railroad bridge to Boston and Maine Railroad bridge.—Lieutenant-Colonel Mansfield submitted report of survey December 21, 1894. The plan of improvement proposed by him is to dredge a cut 150 feet wide and 18 feet deep at mean high water, at an estimated cost of $65,000. The report was transmitted to Congress and printed in House Ex. Doc. No. 162, Fifty-third Congress, third session. (See also Appendix B 26.)

5. Survey of East Boston Channel, Boston Harbor, Massachusetts.—Lieutenant-Colonel Mansfield submitted report of survey October 15, 1894. The project proposed by him is to dredge a cut 150 feet wide, 10 feet deep at mean low water, from deep water in the Jeffreys Point Channel to near the sea wall of the Boston, Revere Beach and Lynn Railroad, at an estimated cost of $60,000. The report was transmitted to Congress and printed in House Ex. Doc. No. 58, Fifty-third Congress, third session. (See also Appendix B 27.)

6. Survey of Salem Harbor, Massachusetts.—The river and harbor act of August 17, 1894, directs that a survey be made of Salem Harbor, Massachusetts, with a view to improving the harbor channel to the mouth of South River, so as to afford a width of 500 feet and a depth of at least 10 feet at mean low water, and for securing a channel not less than 10 feet deep at mean low water from the mouth of South River to Derby Wharf, beginning with a width of 300 feet and gradually narrowing, so that there shall be at said wharf a width of not less than 160 feet; and with a view of dredging the Middle Ground, so called, between Haste Ledge and Aqua Vitæ, so as to give a depth of 25 feet at mean low water.

The report of the results of the survey thus provided for was submitted to this office by Lieutenant-Colonel Mansfield under date of April 18, 1895. He states that the harbor channel has a greater width than 500 feet and a depth at least equal to that mentioned in the act,

but to improve South River from its mouth to Derby Wharf to afford a channel of the dimensions specified will require the removal of 48,791 cubic yards of material, which, at 25 cents per cubic yard, will cost, with contingencies added, $14,000. He further estimates that to remove the Middle Ground, so called, between Haste Ledge and Aqua Vitæ, so as to give a depth of 25 feet at mean low water, calls for the dredging of a channel 8,400 feet long, 500 feet wide, at a total estimated cost of $535,000. His report is submitted herewith. (See Appendix B 28.)

Lieutenant-Colonel Mansfield was also charged with the duty of making survey of Great Salt Pond, Block Island, Rhode Island, with a view of making harbor of refuge therein, and report of the results will be duly submitted when received.

IMPROVEMENT OF RIVERS AND HARBORS IN SOUTHEASTERN MASSACHUSETTS, IN RHODE ISLAND, AND IN EASTERN CONNECTICUT.

This district was in the charge of Capt. W. H. Bixby, Corps of Engineers, to June 8, 1895, with Lieut. W. W. Harts, Corps of Engineers, under his immediate orders, and in the temporary charge of Lieutenant Harts since June 8. Division Engineer, Col. H. L. Abbot, Corps of Engineers.

1. Harbor of refuge at Hyannis, Mass.—This harbor before improvement was an open roadstead, exposed to southerly storms. In the years 1827–1838 a breakwater of riprap granite 1,170 feet long was constructed, covering an anchorage of about 175 acres, the entrance to which has a depth of about 15½ feet. Between the years 1852 and 1882 extensive repairs were made, increasing the width of its base and the size of the stone forming its sides and top.

The approved project of 1884 provides for the dredging to 15.5 feet depth at low water of about 36 acres of shoal area north of the existing breakwater, so as to increase the deep-water harborage by that amount; all at a total cost estimated in 1884 at $45,743.20 (including $81.20 left over from a former project), of which $37,581.20 was appropriated prior to 1895.

At the adoption of the present project the 15.5-foot depth anchorage covered only about 47 acres, and the 36 additional acres to be dredged carried an average of about 12 feet depth of water at low water.

The sum of $33,573.13 had been expended on this work up to June 30, 1894, by which 20 acres out of 36 had been dredged.

During the past fiscal year plans have been made for work under the new appropriation, and contract for the dredging entered into, work to be completed September 1, 1896. No other work than that of preparation has yet been done.

The balance available will be applied to increasing the dredged area.

July 1, 1894, balance unexpended		$655.51
Amount appropriated by act of August 17, 1894		3,500.00
		4,155.51
June 30, 1895, amount expended during fiscal year		797.49
July 1, 1895, balance unexpended		3,358.02
July 1, 1895, outstanding liabilities	$12.13	
July 1, 1895, amount covered by uncompleted contracts	2,000.00	
		2,012.13
July 1, 1895, balance available		1,345.89
Amount (estimated) required for completion of existing project		8,162.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		3,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix C 1.)

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2. Harbor of refuge at Nantucket, Mass.—This harbor is the only one between the harbors of Marthas Vineyard (Vineyard Haven and Edgartown) and Provincetown, a distance of about 100 miles, except the small harbor of Hyannis, on the north side of Nantucket Sound. It has deep water inside, and the object of improvement is to make it a harbor of refuge for vessels plying between ports north and south of Cape Cod.

The approved project of 1880, as modified in 1885, provides for the construction of two jetties as training walls, one on each side of the harbor entrance, planned so as to allow the tidal current to assist in scouring out and maintaining a good channel, and for the completion of the work by dredging where necessary to obtain a depth of from 12 to 15 feet at low water in this channel; all at a total cost estimated in 1885 at $375,000, of which $220,000 was appropriated prior to 1895.

At the adoption of the present project no jetties existed and the channel entrance was barred by a shoal of 1.5 miles width, on which there was only 6 feet depth of water at low tide, the channel being very crooked and subject to changes in location.

The sum of $179,036.14 had been expended on this work up to June 30, 1894, by which the west jetty had been built to 3,955 feet length with full height, the east jetty had been built to 834 feet length with full height, then the foundation laid for a length of 191 feet, beyond which 1,300 feet length had been raised to half-tide level, and then 420 feet length raised to nearly low tide, the total length from shore end to outer end being now 2,905 feet.

During the past fiscal year contracts have been made for work under the appropriation of August 17, 1894, and contract for stonework entered into, work to be completed December 15, 1895. The stonework has been commenced and 2,084 tons of stone was placed in the east jetty, thereby extending it 120 feet.

The balance available is to be applied to the further extension of the east jetty.

July 1, 1894, balance unexpended		$19,534.82
Amount appropriated by act of August 17, 1894		25,000.00
		44,534.82
June 30, 1895, amount expended during fiscal year		19,709.25
July 1, 1895, balance unexpended		24,825.57
July 1, 1895, outstanding liabilities	$3,112.07	
July 1, 1895, amount covered by uncompleted contracts	15,390.48	
		18,502.55
July 1, 1895, balance available		6,323.02

Amount (estimated) required for completion of existing project 155,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897 25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix C 2.)

3. Marthas Vineyard inner harbor at Edgartown, Mass.—The inner harbor at Edgartown lies in the northern part of the waterway or strait that separates Chappaquiddick Island from the east end of Marthas Vineyard. It extends southward about 1½ miles from Chappaquiddick Point opposite Edgartown and averages about one-fifth of a mile in width.

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This harbor is so completely landlocked as to form a safe harbor of refuge for small vessels, but the contracted width of the entrance and the resulting velocity of the tidal currents make it difficult to pass through.

The approved project of 1889 provides for the removal to 10 feet depth at low water of a "middle ground" shoal in the central part of the inner harbor, at a total cost estimated in 1893 at $7,000, all of which was appropriated prior to 1895.

At the adoption of the present project the "middle ground" shoal carried only about 6 feet depth of water and was a very troublesome obstruction.

The sum of $4,498.59 had been expended on this work up to June 30, 1894, by which about three-quarters of the shoal had been dredged to full depth.

During the year plans have been made for work under the new appropriation and contract for dredging entered into, work to be completed September 1, 1896. No work other than that of preparation has been done.

The balance available will be applied to the further removal of the "middle ground" shoal.

July 1, 1894, balance unexpended		$8.11
Amount appropriated by act of August 17, 1894		2,500.00
		2,508.11
June 30, 1895, amount expended during fiscal year		340.91
July 1, 1895, balance unexpended		2,167.20
July 1, 1895, outstanding liabilities	$13.74	
July 1, 1895, amount covered by uncompleted contracts	1,200.00	
		1,213.74
July 1, 1895, balance available		953.46

(See Appendix C 3.)

4. Harbor at Vineyard Haven, Mass.—Vineyard Haven is a deep indentation in the northern shore of the island of Marthas Vineyard, on the southern side of Vineyard Sound. The approved project of 1887, as modified in 1889, provides for the protection of the "Chops" (or headlands) from erosion and the intervening harbor from being filled by the eroded material; the whole to be done by means of stone sea walls and jetties to be built along the beach in front of the bluffs at both headlands. The total cost was estimated in 1889 at $60,000, of which $50,000 was appropriated prior to 1895.

At the adoption of the present project the headlands were gradually wearing away and the adjacent parts of the harbor were shoaling. No protection works were in existence.

The sum of $40,852.63 had been expended on this work up to June 30, 1894, by which there had been built a sea wall of 575 feet length and a jetty of 50 feet length at the East Chop, and at the West Chop a sea wall of 880 feet length, three jetties of 150, 135, and 280 feet length, a wharf, and a short breakwater of 60 feet length; completing over two-thirds of the needed work.

During the past fiscal year work on the sea wall under old contracts was completed at the East Chop, making this wall about 960 feet total length. Plans were prepared for work under the new appropriation.

The balance available will be applied to continuing the work of protection at both chops.

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July 1, 1894, balance unexpended	$2,104.49
Amount appropriated by act of August 17, 1894	7,500.00
	9,604.49
June 30, 1895, amount expended during fiscal year	2,286.89
July 1, 1895, balance unexpended	7,317.60
July 1, 1895, outstanding liabilities	2.50
July 1, 1895, balance available	7,315.10
Amount (estimated) required for completion of existing project	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	7,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893	

(See Appendix C 4.)

5. Harbor of refuge at Woods Hole, Massachusetts.—Woods Hole is a waterway connecting Buzzards Bay and Vineyard Sound and lying near the southwestern part of Cape Cod, Massachusetts. The name is also applied to the village and harbor in the near vicinity.

Before improvement the site of the present works was a submerged point of land extending from the shore of the harbor.

The approved project of 1883, extended in 1884 and 1886, provided for the construction of retaining walls on shore, a stone pier, and a wooden wharf mainly for the use of the United States Fish Commission and incidentally for the use of the other branches of the public service, all of which work had been completed prior to 1889.

The amount previously expended on this work prior to the present fiscal year was $92,506.66, with which the retaining walls, stone pier, and wooden wharves had all been built.

During the past fiscal year the amount expended, including outstanding liabilities, was $3,298.82, by which the repairs to the United States Fish Commission pier and wharves, due to injuries by storms, etc., were nearly completed.

The amount available will be used to complete the repairs.

Amount appropriated by sundry civil act approved March 2, 1895	$5,000.00
June 30, 1895, amount expended during fiscal year	951.13
July 1, 1895, balance unexpended	4,048.87
July 1, 1895, outstanding liabilities	2,347.69
July 1, 1895, balance available	1,701.18

(See Appendix C 5.)

6. Wareham Harbor, Massachusetts.—The object of the improvement is to deepen and widen the channel leading from Buzzards Bay to Wareham. The commerce of Wareham is carried on in sailing vessels, and the channel is to be made a beating channel for such vessels. Another object of the improvement is the raising of Long Beach.

The approved project of 1880 provides for the deepening and widening of the channel from Buzzards Bay to Wareham, so as to obtain 9 feet depth at low water over 250 feet width from the entrance up to Barneys Point, thence the same depth over 350 feet width up to the lower wharves of the city, and thence the same depth and 200 feet width opposite the city front; and for the raising and protecting of Long Beach (the eastern headland of the entrance) so as to prevent the erosion of this beach and the shoaling of the adjacent parts of the

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channel and harbor; all at a total cost estimated in 1887 at $56,236, of which all was appropriated prior to 1895.

At the adoption of the present project the headland of Long Beach was wearing off and the adjacent parts of the channel and harbor were shoaling. The channel was narrow and crooked, and limited to 7 feet depth at low water.

The sum of $55,827.95 had been expended on this work up to June 30, 1894, by which the channel had been deepened to over three-quarters width and full depth of 9 feet in its upper portion, and to over half width in its lower portions, and the sand spit had been partly protected by catch-sand fences and brush and stone work.

The ruling depth of the approaches to Wareham had been increased from 7 to 9 feet, and the channel greatly widened in all the reaches. Vessels can be carried to Wareham with larger draft than formerly. The increase in width of channel had been a great help to all vessels in beating in and out of the harbor.

During the past fiscal year, no fieldwork has been done; but arrangements have been made for a resurvey of the harbor to determine what further improvements are still necessary.

Further dredging must await further appropriations.

July 1, 1894, balance unexpended	$474.78
June 30, 1895, amount expended during fiscal year	205.97
July 1, 1895, balance unexpended	268.81
July 1, 1895, outstanding liabilities	3.33
July 1, 1885, balance available	265.48

(See Appendix C 6.)

7. *New Bedford Harbor, Massachusetts.*—New Bedford Harbor is an estuary of Buzzards Bay, and is the port of the cities of New Bedford and Fair Haven.

Before improvement the channel had a depth of about 12½ feet at mean low water. Old projects of 1874 and 1877 provided for a channel 300 feet wide and 15 feet deep at mean low water from the deep water just above Palmer Island to the wharves at New Bedford. This work was completed in 1877, at a cost of $20,000.

The approved project of 1887 provides for the deepening, widening, and straightening of the channel from Buzzards Bay to New Bedford, so as to obtain 18 feet depth at low water over 200 feet width and over its entire length, at a total cost estimated in 1887 at $35,000, all of which was appropriated prior to 1895.

At the adoption of the present project the channel was winding, and only about 15 feet deep.

The sum of $26,871.24 had been expended on this work up to June 30, 1894, by which the uppermost reach—that above Palmers Island—had been completed to full dimensions, the upper half of the remaining reaches had been dredged to two-thirds width and full depth, and a slightly crooked channel of full dimensions existed over the remaining half, wandering a little from the projected channel.

During the past fiscal year plans have been made for work under the new appropriation, and contract for dredging entered into, work to be completed September 1, 1896. No work of dredging has yet been done, but a minor survey was made to determine the location and cost of future work.

The balance available will be applied to continuing the improvement and completing the project.

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July 1, 1894, balance unexpended		$680.56
Amount appropriated by act of August 17, 1894		7,500.00
		8,180.56
June 30, 1895, amount expended during fiscal year		602.03
July 1, 1895, balance unexpended		7,578.53
July 1, 1895, outstanding liabilities	$197.07	
July 1, 1895, amount covered by uncompleted contracts	5,000 00	
		5,197.07
July 1, 1895, balance available		2,381.46

(See Appendix C 7.)

8. Canapitsit Channel, Massachusetts.—This waterway lies about 20 miles south of New Bedford, running between the islands of Cuttyhunk and Nashawena, and connecting the waters of Vineyard Sound and Buzzards Bay.

The object of the improvement is to make this channel safe for the use of light-draft sailboats, and also especially of the surfboats belonging to the life-saving station of this dangerous locality.

The approved project of 1891 provides for the widening and deepening of the present channel from Vineyard Sound to the ocean between the islands of Nashawena and Cuttyhunk, Massachusetts, so as to secure a depth of 6 feet at low water, with a least width of 150 feet over its entire length, at a total cost estimated in 1893 at $9,800, all of which had been appropriated prior to 1895.

At the adoption of the present project the sand shoals, and especially the numerous bowlders, made this passage specially dangerous to the life-saving-station boats and other shallow-draft row and sail boats.

The sum of $4,721.31 had been expended on this work up to June 30, 1894, by which a channel of about 66 feet width and at least 5 feet depth at low water had been cut entirely across the shoal, completing about half of the proposed work.

During the past fiscal year plans have been made for work under the new appropriation, and contract for dredging entered into, work to be completed September 1, 1896. No other work except that of preparation has been done.

The balance available will be applied to completing the project.

July 1, 1894, balance unexpended		$119.70
Amount appropriated by act of August 17, 1894		5,000.00
		5,119.70
June 30, 1895, amount expended during fiscal year		513.74
July 1, 1895, balance unexpended		4,605.96
July 1, 1895, outstanding liabilities	$15.37	
July 1, 1895, amount covered by uncompleted contracts	3,500.00	
		3,515.37
July 1, 1895, balance available		1,090.59

(See Appendix C 8.)

9. Taunton River, Massachusetts.—This river rises in Norfolk County, Mass., and empties into Narragansett Bay at Fall River. The object of the improvement is to deepen and widen the channel leading to the city of Taunton, at the head of navigation, so that vessels of 11 feet draft can reach the city at high water.

In its original condition the channel was narrow and obstructed by bowlders, and from Berkley Bridge to Taunton the depth was not, in

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places, more than 5 feet at mean high water. A vessel of 30 tons burden was as large as could go up to Taunton.

From 1870 to 1879 $63,000 was appropriated to secure 9 feet depth at high water. This work was completed in 1879.

The approved project of 1880 provides for the widening and deepening of the river so as to secure a channel of at least 12 feet depth at high water, with 100 feet width from its mouth up to Berkley Bridge (above Dighton), thence 12 feet depth with 80 feet width (100 feet width at bends) up to Briggs Shoal, thence 11 feet depth with 80 feet width up to the shipyard, thence 11 feet depth with 60 feet width up to Weir Bridge, Taunton; all at a total cost estimated in 1893 at $125,000, of which $113,000 was appropriated prior to 1895.

At the adoption of the present project the channel was limited to 9 feet at high water, and was too narrow and too much obstructed by bowlders for easy navigation by the craft making use of it.

The sum of $107,998.11 had been expended on this work up to June 30, 1894, by which a large part of the proposed work had been done, especially at the places most complained of by the vessels using this river. Vessels of 11 feet draft could reach Taunton, at the head of navigation.

During the past fiscal year plans have been made for work under the new appropriation, and contract for the dredging entered into, work to be completed by November 1, 1895.

There remains, to complete the existing project, widening and deepening at a few points above the bridge and the removal of a small amount of ledge rock.

The balance on hand will be applied to continuing the improvement.

July 1, 1894, balance unexpended		$51.89
Amount appropriated by act of August 17, 1894		5,000.00
		5,051.89
June 30, 1895, amount expended during fiscal year		336.20
July 1, 1895, balance unexpended		4,715.69
July 1, 1895, outstanding liabilities	$30.89	
July 1, 1895, amount covered by uncompleted contracts	3,000.00	
		3,030.89
July 1, 1895, balance available		1,684.80
Amount (estimated) required for completion of existing project		12,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix C 9.)

10. Pawtucket River, Rhode Island.—This river, otherwise called Seekonk River, is the upper portion of Providence River, and extends from Pawtucket to Providence. Before improvement the channel in the river had a ruling depth of about 5 feet at mean low water.

Between 1867 and 1873 $52,000 was appropriated to dredge the channel to 7 feet depth. This work was finished in 1876.

The approved project of 1883 provides for the deepening of the river so as to secure a channel of at least 12 feet depth at low water, with 100 feet width from its mouth at Providence up to opposite Grant & Co.'s wharf at Pawtucket, and thence 12 feet depth with 40 feet width through a stone ledge for a short distance farther to Pawtucket bridge; all at a total cost estimated in 1883 at $382,500, of which $205,000 was appropriated prior to 1895.

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At the adoption of the present project the channel was narrow and only about 5 feet deep.

The sum of $169,125.79 had been expended on this work up to June 30, 1894, by which the shoalest places in the lower section had been improved and about nine-tenths of the needed work done, securing a channel about 12 feet deep and 100 feet wide up to above the lower wharves of the city of Pawtucket; and at the head of the river the depth had been increased to at least 4 feet at low water over the entire ledge, except a small area of about 25 square feet.

The completed portion of the channel has been already a great benefit to the commerce of the river.

During the fiscal year two contracts were entered into for the removal of ledge rock, work to be completed by September 6, 1895, and January 1, 1896, respectively. Work under each contract had been commenced and was in progress at the close of the year, resulting in clearing the greater portion of the upper section to a depth of 8 feet at low water, and the greater part of the lower section to a depth of 12 feet at low water.

The work yet to be done is to straighten the channel in its lower portions and to deepen the channel through the ledge to full depth with a width of 40 feet.

The balance available will be applied to continuing the improvement.

July 1, 1894, balance unexpended		$11,023.49
Amount appropriated by act of August 17, 1894		25,000.00
		36,023.49
June 30, 1895, amount expended during fiscal year		8,349.79
July 1, 1895, balance unexpended		27,673.70
July 1, 1895, outstanding liabilities	$2,213.77	
July 1, 1895, amount covered by uncompleted contracts	17,251.57	
		19,465.34
July 1, 1895, balance available		8,208.36

Amount (estimated) required for completion of existing project	177,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix C 10.)

11. Providence River and Narragansett Bay, Rhode Island.—The object of this improvement is to furnish a wide and deep channel for foreign and coastwise commerce from the ocean to Providence.

Before the improvement of the river was commenced in 1853 many shoals obstructed navigation, and at one point in the channel, a place called "The Crook," the available low-water depth was but 4½ feet. Between 1852 and 1873 $56,500 was appropriated to secure first 9 and then 12 feet depth of channel. This work was finished in 1873.

The approved project of 1878, as modified in 1882, provides for the deepening of the river and the deepening and widening of its anchorage basins, so as to secure a channel of at least 25 feet depth at low water with 300 feet width from the deep water of Narragansett Bay up to Providence, R. I., and so as to secure anchorage basins of 20 feet depth with 600 feet width, 18 feet depth with 725 feet width, 12 feet depth with 940 feet width, and 6 feet depth with 1,060 feet width, from Fox to Field Point; all at a total cost estimated in 1882 at $675,000, of which $627,500 was appropriated prior to 1895.

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At the adoption of the present project the channel was limited to 12-foot depths, and the anchorage areas were much too small and shallow for the craft seeking them.

The sum of $608,559.45 had been expended on this work up to June 30, 1894, by which the channel and anchorage areas had been dredged once to full widths and depths, the 25-foot depth channel, however, now needing redredging. A channel survey had been made from the mouth of Pawtucket (Seekonk) River at Fox Point down to and including the Pawtuxet Reach at Sabine Point, to determine the amount of further work there necessary.

During the past fiscal year plans have been made for work under the new appropriation and contract for the dredging entered into, work to be completed by December 1, 1895.

There is required for the completion of the existing project a final redredging of the main channel where it has shoaled since 1882.

The balance available will be applied to continuing the improvement.

July 1, 1894, balance unexpended		$2,543.04
Amount appropriated by act of August 17, 1894		17,500.00
		20,043.04
June 30, 1895, amount expended during fiscal year		2,659.10
July 1, 1895, balance unexpended		17,383.94
July 1, 1895, outstanding liabilities	$77.39	
July 1, 1895, amount covered by uncompleted contracts	11,000.00	
		11,077.39
July 1, 1895, balance available		6,306.55

Amount (estimated) required for completion of existing project	47,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	17,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix C 11.)

12. Removal of Green Jacket Shoal, Providence River, Rhode Island.—This shoal is in that part of Providence River which constitutes the harbor of Providence. It lies off the wharves, on the south front of the city, and occupies a part of the harbor that is required for anchorage purposes, covering an area of about 18 acres between the 15-foot curves and about 30 acres in all.

The approved project of 1885 provides for the removal to 25 feet depth, at low water, of a middle-ground shoal of about 30 acres area, in Providence River, opposite the city, the portion to be removed to be at least 200 feet distant from the harbor lines of the city; all at a total cost estimated in 1885 at $112,346, of which $96,250 was appropriated prior to 1895.

At the adoption of the present project the shoal in many places carried only 1 foot of water and was a very troublesome obstruction.

The sum of $88,785.68 had been expended on this work up to June 30, 1894, by which 20 acres out of the original 30 of this shoal had been dredged to 25 feet depth, and a 16-foot depth had been secured over the central and largest portion of the shoal, in addition to a 20-foot depth in the main channel, making an important addition to the anchorage facilities of Providence Harbor.

During the past fiscal year plans have been made for work under the new appropriation and contract for the dredging entered into, work to be completed by December 1, 1895.

The balance available will be applied to further dredging.

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July 1, 1894, balance unexpended		$482.98
Amount appropriated by act of August 17, 1894		7,500.00
		7,982.98
June 30, 1895, amount expended during fiscal year		625.45
July 1, 1895, balance unexpended		7,357.53
July 1, 1895, outstanding liabilities	$70.97	
July 1, 1895, amount covered by uncompleted contracts	5,500.00	
		5,570.97
July 1, 1895, balance available		1,786.56

Amount (estimated) required for completion of existing project	15,596.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	7,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix C 12.)

13. Newport Harbor, Rhode Island.—This harbor is at the main entrance to Narragansett Bay, and all the year it serves as an easily accessible harbor of refuge to foreign and coastwise commerce.

Before improvement the capacity of the inner harbor was limited by shoals, and it was not adequate to the number and size of the vessels seeking it for refuge. The southern or main entrance was obstructed by a bar which stretched out from Goat Island and the northern entrance by a sharp rocky spit near Rose Island, and the general business wharves of the city could not be reached at low tide by vessels drawing more than 8 feet.

Between 1873 and 1875 $28,500 was appropriated to secure 12 feet depth in the harbor. This work was completed in 1876.

The approved project of 1880, as modified in 1882, 1883, 1884, 1890, and 1895, provides for the widening and deepening of the channel from Narragansett Bay into Newport, so as to secure 15 feet depth at low water with at least 750 feet width; for the extension of the 13-foot depth and 10-foot depth anchorage basins; for the partial cutting off of the shoal spit at the southern end of Goat Island, and for the construction of jetties on the western shore of Goat Island so as to protect the end of this island from erosion, and to prevent the drift of sand, etc., around the island into the adjacent parts of the channel and harbor and the removal of "Spindle Rock," a sharp rocky spit near Rose Island; all at a total cost estimated in 1895 at $206,200, of which $137,000 was appropriated prior to 1895.

At the adoption of the present project this harbor was limited to 12 feet depth at low water, and its anchorage area was too small for the craft seeking harborage at this place during the summer and all the year during storms.

The sum of $127,591.35 had been expended on this work up to June 30, 1894, by which the 15-foot channels and 13-foot anchorage basins had been dredged, the shoal spit at the southern end of Goat Island had been cut off, and one jetty 133 feet long had been built westward from Goat Island. The southern entrance had been completed for vessels of 15 feet draft, and of the total area to be dredged within the harbor (about 90 acres) about 75.25 acres had been completed.

During the past fiscal year plans have been made for work under the new appropriation, and bids to be opened in July were solicited for the removal of ledge rock from "Spindle Rock" in the outer harbor, work to be completed by December 1, 1895.

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The work required to complete the existing projects is the excavation of a small remaining portion of the 10-foot anchorage area; also the building of additional jetties outside of Goat Island, whenever they may be required, to arrest the drift of littoral sand and gravel into the harbor entrance, and the removal of the "Spindle Rock" obstruction.

The balance available is to be applied to continuing the improvement.

July 1, 1894, balance unexpended	$1,940.93
Amount appropriated by act of August 17, 1894	7,500.00
	9,440.93
June 30, 1895, amount expended during fiscal year	1,401.49
July 1, 1895, balance unexpended	8,039.44
July 1, 1895, outstanding liabilities	54.73
July 1, 1895, balance available	7,984.71
Amount (estimated) required for completion of existing project	69,200.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix C 13.)

14. Harbor of refuge at Point Judith, Rhode Island.—Point Judith is the southeastern extremity of South Kingston, R. I., and marks the southwestern entrance to Narragansett Bay. A long ledge, known as Squid Ledge, extends for nearly a mile in a south-by-easterly direction about 1½ miles west of the point.

The approved project of 1889 provides for the construction of a national harbor of refuge nearly a mile square at this point by means of stone breakwaters, built partly on Squid Ledge and planned so as to give protection against easterly, southerly, and westerly storms, the mainland itself forming a protection on the north, all at a total cost estimated in 1889 at $1,250,000, of which $650,000 was appropriated prior to 1895.

By the act of July 13, 1892, authority was given to the Secretary of War to make contracts for the completion of the project, on the basis of the above-estimated total cost, the work to be paid for as appropriations may from time to time be made by law.

At the adoption of the project this point was a specially dangerous place for boats and tows to pass during storms and even ordinarily bad weather.

The sum of $198,752.46 had been expended on this work up to June 30, 1894, by which the breakwater had been commenced at its center, extended to a total length of about 3,000 feet on the bottom and about 2,000 feet length raised to about low-water level, and a beacon light established thereon.

During the past fiscal year, work of placing stone under the old contract was continued, by which about 200,000 tons of stone has been placed in the breakwater, raising about 2,600 feet length up to about low-water level, and extending the breakwater to a total length of about 5,000 feet on the bottom.

It is proposed to apply the balance available and the appropriation asked for to continuing the construction of the breakwater.

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July 1, 1894, balance unexpended		$86,729.82
Amount appropriated by sundry civil act approved August 18, 1894		100,000.00
Amount appropriated by sundry civil act approved March 2, 1895		300,000.00
		486,729.82
June 30, 1895, amount expended during fiscal year		210,366.80
July 1, 1895, balance unexpended		276,363.02
July 1, 1895, outstanding liabilities	$77,626.44	
July 1, 1895, amount covered by uncompleted contracts	140,244.46	
		217,870.90
July 1, 1895, balance available		58,492.12

Amount (estimated) required for completion of existing project 600,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897 600,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix C 14.)

15. Entrance to Point Judith Pond, Rhode Island.—Point Judith Pond is a shallow-draft salt pond, lying in rear of the sandy beach of the Rhode Island shore, just west of Point Judith.

The improvement desired at this place by the people of the neighborhood is the reopening of an old entrance long ago closed by the ocean storms.

The present entrance to this pond is very shallow (less than 3 feet), crooked, and variable in location, and lies about a mile west of the former entrance (now closed) where the improvement is desired.

There is at present no approved project for the improvement of this pond entrance, it having been reported as unworthy of Government improvement.

During the past fiscal year a minor survey of the locality has been made, the report on which, dated July 2, 1895, is printed with the annual report of the district officer. From the facts stated it was believed that the benefits to be secured from the improvement authorized by the act of August 17, 1894, would be small, local in their nature, and insufficient from the standpoint of the public interests to justify the expenditure of the money made available by the act. The Secretary of War accordingly directed that action be delayed until the subject can be again considered by Congress with the additional information furnished by this survey.

This locality having been frequently reported as unworthy of improvement by the United States, no further appropriations are considered advisable.

July 1, 1894, balance unexpended	$7,347.38
Amount appropriated by act of August 17, 1894	2,500.00
	9,847.38
June 30, 1895, amount expended during fiscal year	194.97
July 1, 1895, balance unexpended	9,652.41
July 1, 1895, outstanding liabilities	130.62
July 1, 1895, balance available	9,521.79

(See Appendix C 15.)

16. Harbor of refuge at Block Island, Rhode Island.—This island is about 14 miles east of the eastern end of Long Island and about 10 miles distant from the nearest point of the mainland.

The object of the improvement is to furnish a harbor of refuge for vessels engaged in foreign and coastwise commerce.

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Before the construction of the present harbor Block Island had no harbor which afforded protection for decked vessels.

Between 1870 and 1876 $285,000 was appropriated for a breakwater for a harbor for medium-draft vessels, this work being completed in 1878. Between 1880 and 1882 $25,000 was appropriated for an inner basin and the protection of the shore next the breakwater, this work being completed in 1884. In 1884 $15,000 was appropriated for additions to the old breakwater, this money being so spent and work completed in 1884–85.

The approved project of 1884, as modified in 1888, provides for the construction of a harbor of refuge on the eastern side of the island, consisting of an enlarged inner harbor (or basin) for small vessels and an exterior harbor for larger ones. The basin was to be about 800 feet square and completely inclosed except at its 100-foot-wide entrance. The exterior harbor was already formed by an old breakwater on the east and the adjacent shore on the south and west; but an old gap near the end of this breakwater was to be filled up. The project covers the construction of the stone sea walls of the enlarged inner harbor ($46,000), the repair of the old breakwater ($24,000), and a little dredging ($5,000) along the western side of the old breakwater and also inside the harbor; all at a total cost estimated in 1888 at $75,000, of which $74,000 was appropriated prior to 1895.

At the adoption of the present project, this harbor was neither large enough nor well enough protected for the proper harborage of the craft seeking refuge at this place during storms and bad weather.

The sum of $71,937.26 had been expended on this work up to June 30, 1894, by which the gap in the old breakwater had been filled up so as to make the breakwater of 1,900 feet total length; the sea walls of the inner harbor had been completed (except as to stone fender piers at the entrance); wooden fender piers had been built for present uses; the worst rocks and bowlders had been removed from the new inner harbor; and the shoal west of the breakwater had been dredged to a depth of 9 feet from the steamboat wharf to within 100 feet of the north wall.

During the past fiscal year plans have been made for work under the new appropriation, an agreement made to do the small amount of needed dredging, and the dredging itself has been commenced, and the shoaled entrance to the inner harbor had nearly all been dredged to a depth of 12 feet at low water, and the shoaled southwest corner of the inner basin had nearly all been dredged to a depth of 9 feet at low water.

The balance on hand will be applied to the continuation of the work under the existing project.

July 1, 1894, balance unexpended	$2,485.56
Amount appropriated by act of August 17, 1894	2,500.00
	4,985.56
June 30, 1895, amount expended during fiscal year	2,064.95
July 1, 1895, balance unexpended	2,920.61
July 1, 1895, outstanding liabilities	1,162.22
July 1, 1895, balance available	1,758.39

(See Appendix C 16.)

17. Pawcatuck River, Rhode Island and Connecticut.—The navigable part of the Pawcatuck River extends from the town of Westerly to Little Narragansett Bay, and the object of the improvement is to deepen and widen this channel.

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Before improvement the channel was crooked and obstructed by numerous shoals, on some of which there was but 1¼ feet of water at mean low water.

Between 1871 and 1876 $50,000 was appropriated for the excavation of a channel 5½ feet deep at mean low water and 75 feet wide below the wharves, and from 35 to 40 feet wide between the upper and lower wharves, this work being completed in 1876.

The approved project of 1885 provides for the deepening and widening of the river so as to secure a channel of at least 8 feet depth at low water, with 100 feet width from its mouth up to the lower wharves of Westerly, and thence a channel of the same depth with about 40 feet width up to the upper wharves of the city; all at a total cost estimated in 1891 at $42,400, and $48,400 has been appropriated up to 1895.

At the adoption of the present project the channel was limited to 5.5 feet depth, over 75 feet width below the city, and the same depth over 35 feet width opposite the city; and rock ledges obstructed the channel at several points.

The sum of $41,295.29 had been expended on this work up to June 30, 1894, by which the 8-foot channel had been completed from deep water upward for full width to within a half mile of the city, and for partial width for the remaining distance; and the rock ledge obstructions had been removed from about 3,000 feet length of the 40-foot channel between the wharves of Westerly, and from about 1,000 feet length of the 100-foot channel below the city.

During the past fiscal year plans have been made for work under the new appropriation and contract for the dredging entered into, work to be completed October 1, 1895. Dredging has been commenced and a channel completed of 8 feet depth at low water and 40 feet width for a distance of 1,550 feet, and 20 feet width for an additional distance of 950 feet opposite the lower wharves of the city of Westerly.

The balance available will be applied to the extension of the channel according to the project.

July 1, 1894, balance unexpended		$1,166.08
Amount appropriated by act of August 17, 1894		6,000.00
		7,166.08
June 30, 1895, amount expended during fiscal year		920.28
July 1, 1895, balance unexpended		6,245.80
July 1, 1895, outstanding liabilities	$2,140.12	
July 1. 1895, amount covered by uncompleted contracts	3,506.35	
		5,646.47
July 1, 1895, balance available		599.33

(See Appendix C 17.)

18. Harbor of refuge at Stonington, Conn.—Stonington Harbor lies on the north side of the eastern entrance from the ocean into Long Island Sound, and its breakwaters are for the purpose of making the harbor a harbor of refuge for vessels entering and leaving this eastern entrance of the sound. Stonington Harbor originally was an open bay, unprotected from southerly storms and obstructed by a shoal having a low-water depth of but 6 feet at the shoalest part. Between 1827 and 1831 about $37,000 was spent in constructing piers or breakwaters in the inner harbor for the protection of the general harborage. Between 1871 and 1873 $46,166 was appropriated for a survey of the harbor and for dredging the harbor to 12 feet depth, this work being finished in 1875. Between 1875 and 1879 $112,500 was appropriated for the construction of a western breakwater about 2,000 feet long, extending to

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18 feet depth of water, and for dredging the harborage to 12 feet depth inside this breakwater, this work being completed in 1880.

The approved project of 1880 provides for the construction of an eastern breakwater as a protection to the outer harbor, this breakwater, about a half mile long, to extend from the vicinity of Bartletts Reef to the vicinity of the Middle Ground Shoal, or until it gives sufficient protection to the harbor against southerly winds; all at a total cost estimated in 1884 at $143,000, and $148,000 has been appropriated up to 1895.

At the adoption of the present project the harbor had no eastern breakwater.

The sum of $132,578.59 had been expended on this work up to June 30, 1894; this expenditure resulted in the extension of this eastern breakwater to a total length of 2,377 feet.

During the past fiscal year minor surveys were made and contract work commenced and completed under the 1892 appropriation for the further extension of the breakwater, thereby extending the same to a total length of nearly 3,000 feet. Plans have been made for work under the 1894 appropriation, and bids have been solicited (to be opened in July) for dredging across Noyes Shoal; this work to be completed by December 1, 1895.

The balance on hand will be expended in dredging on Noyes Shoal.

July 1, 1894, balance unexpended	$10,670.67
Amount appropriated by act of August 17, 1894	5,000.00
	15,670.67
June 30, 1895, amount expended during fiscal year	10,637.52
July 1, 1895, balance unexpended	5,033.15
July 1, 1895, outstanding liabilities	153.06
July 1, 1895, balance available	4,880.09

(See Appendix C 18.)

19. Removing sunken vessels or craft obstructing or endangering navigation.—a. Wreck near Parkers River.—This wreck, lying near the shore of Nantucket Sound, Massachusetts, between Parkers River and Bass River, having caused serious damage to several vessels navigating this vicinity, was entirely removed to the level of the surrounding ocean bottom by the Government force and plant, work being completed in September, 1894.

b. Wreck of barge Shamokin.—This barge, loaded with coal, was sunk by collision in June, 1894, in Pollock Rip Channel, eastern entrance to Nantucket Sound, Massachusetts. She was removed by the Government force and plant, the work being completed in September, 1894.

c. Wreck at Woods Hole, Massachusetts.—This unknown vessel, sunk several years ago near the United States Revenue Marine wharf in Woods Hole Harbor, being dangerous to navigation, was removed by the Government force and plant, the work being completed during September.

d. Wreck in Buzzards Bay, Massachusetts.—A large portion of some unknown wrecked vessel, first found adrift in Buzzards Bay and later found lodged near Naushon Island, being dangerous to navigation, was completely destroyed by the Government force and plant during the same month.

e. Wreck of schooner Dora M. French.—This vessel was sunk in September, 1894, by collision, in the western entrance to Vineyard Sound, about 1.5 miles from the southwest bluff of Cuttyhunk, its masts endan-

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gering the safety of other craft using this vicinity. The obstructing portions were removed by the Government force and plant, work being completed in December, 1894.

f. Wreck of schooner Mary J. Castner.—This schooner, loaded with iron, was run into during a dense fog while at anchor and sunk in Pollock Rip Slough, about 1.75 miles from Chatham Beach, and was reported in September as a dangerous obstruction. Her removal was completed in November, 1894, by the Government force and plant.

g. Wreck of schooner Light of the East.—This schooner, loaded with stone, sunk in October on the Kill Pond Bar, in Nantucket Sound, about 2.5 mile ESE. of the Bass River Light Station. She was removed by the Government force and plant, work being completed in December, 1894.

h. Wreck of schooner Maria Adelaide.—This schooner, wrecked several years ago on the Vineyard Sound side of Cuttyhunk Beach, was, during the severe storm of October 10, 1894, washed entirely across the beach and lodged on the Buzzards Bay side, where she became an obstruction to navigation. She was removed by the Government force and plant in December, 1894.

i. Wreck of schooner S. S. Scranton.—This schooner, loaded with brick, was reported in November, 1894, as lying sunk in the entrance to Buzzards Bay, Massachusetts, about 1 mile southwest of Mishaum Point. Her obstructing portions were removed by the Government force and plant in December, 1894.

j. Wreck of schooner E. K. Hart.—This schooner, loaded with paving stone, was reported in November, 1894, as lying sunk near the middle of Tarpaulin Cove Harbor, Naushon Island, Massachusetts, and as therefore being dangerous to navigation. She was completely removed in December, 1894, by the Government force and plant.

k. Wreck of schooner Julia E. Pratt.—This schooner, originally wrecked about ten years ago on Great Point Rip while loaded with lumber, and later sinking in the southeastern part of Nantucket Harbor, was complained of in December, 1894, as an obstruction requiring removal. She was completely broken up and removed by the Government force and plant in January, 1895.

l. Wreck of schooner Ellen Morrison.—This vessel, loaded with lumber, was originally wrecked on Shovelful Shoal, but later broke up and lodged or sunk in the vicinity of the entrance to the Powder Hole Harbor, Monomoy. She was broken up and removed by the Government force and plant in January, 1895.

m. Wreck near western entrance to Vineyard Sound.—This wreck, supposed to be that of the schooner *Harry L. Whiton*, was reported in January, 1895, as then lying sunk about 2 miles northwest of Browns Ledge and as endangering the safety of all passing craft. Her obstructing portions were completely removed by the Government force and plant in January, 1895.

n. Wreck of schooner Royal Arch.—This schooner, loaded with coal, was sunk in November on a newly found shoal while swinging at anchor in Pollock Rip about 4 miles northeast of the Monomoy Light Station. During the two months' delay required by law the wreck was very much broken up by storms, but removal of the remaining parts was completed in February, 1895, by the Government force and plant.

o. Wreck in Pollock Rip.—An unknown submerged wreck was in December, 1894, reported as then lying sunk on Pollock Rip Shoals and as having caused the wreck of the *Royal Arch*. On investigation (at the time of removal of the *Royal Arch*) what was at first supposed to

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be a submerged wreck was found to be a newly formed shoal not shown on the Coast Survey charts.

p. Wreck on Bearses Shoal.—An unknown schooner was found in January, 1895, sunk on Bearses Shoal near Pollock Rip, about 2.5 miles northeast of the Monomoy Light Station, and reported to be dangerous to navigation. She was broken up and completely removed in March, 1895, by the Government force and plant.

q. Wreck in Vineyard Sound near Vineyard Sound light-ship.—An unknown wreck was in February, 1895, reported as then lying sunk midway between the Vineyard Sound light-ship and the Sow and Pigs Reef buoy. This wreck was removed by the Government force and plant, work being completed in April, 1895.

r. Wreck of barge off Point Judith.—This wreck, lying sunk a short distance southeast of Point Judith, being a specially dangerous obstruction, was removed by the Government force and plant, work being completed in April, 1895.

s. Wreck in Chatham Roads.—This vessel, sunk in February, 1895, off the northern part of the Common Flats in Chatham Roads, Nantucket Sound, Massachusetts, being dangerous to navigation, was removed by the Government force and plant, work being completed during the same month.

t. Wreck of schooner Josiah R. Smith.—This schooner, loaded with coal, was sunk in Vineyard Sound during April, 1895, about 2 miles northwest from Gay Head. Her masts and rigging were removed to about 60 feet depth at low water by the Government force and plant, work being completed in June, 1895.

u. Wreck of barge Oneonta.—This barge, loaded with coal, was sunk by collision in April, 1895, in Pollock Rip about 1.75 miles west by south of the Pollock Rip light-ship, and lies where she is a great danger to the navigation of that neighborhood. Her removal by the Government force and plant was commenced in June, 1895, and the work was still in progress and nearly completed at end of the fiscal year.

The cost of the work on the wrecks during the year was $7,103.08.

(See Appendix C 19.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations and surveys of the following localities, required by the act of August 17, 1894, were made by the local engineer, and reports thereon submitted through the Division Engineer, Col. Henry L. Abbot, Corps of Engineers:

1. Preliminary examination of Mount Hope Bay and harbor of Fall River, Mass.—Captain Bixby submitted report of examination February 21, 1895. It is his opinion, concurred in by the division engineer and by this office, that this locality is worthy of improvement by the General Government. The cost of a survey necessary for preparation of plan and estimate of cost of improvement is estimated to be $3,000. The report was transmitted to Congress and printed in House Ex. Doc. No. 345, Fifty-third Congress, third session. (See also Appendix C 20.)

2. Preliminary examination of stone bridge, over Sakonnet River, Rhode Island, to ascertain the cost of widening and deepening the passage at the draw of said bridge.—Captain Bixby submitted report of examination January 15, 1895. He reports that in the order of the Secretary of War of July 1, 1893, directing the Old Colony Railroad Company to open its drawbridge to 100 feet width, no particular depth was specified, but that the request of the petitioners and the past recommendations of the local United States engineer officer agree upon a clear

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depth of 25 feet as necessary to present and future navigation, and that, for the reasons given, it is his opinion that the stone bridge over the Sakonnet River, so far as concerns the enlargement of its draw opening to 100 feet clear width and 25 feet clear depth at low water, is worthy of improvement by the General Government. This opinion is concurred in by the division engineer and by this office. The cost of the work above indicated is estimated to be $40,000. The report was transmitted to Congress and printed in House Ex. Doc. No. 239, Fifty-third Congress, third session. (See also Appendix C 21.)

3. Preliminary examination of Onset Harbor, Massachusetts.—The report of Captain Bixby upon this examination was submitted under date of May 31, 1895. It is his opinion, concurred in by the division engineer and by this office, that Onset Harbor is not at present worthy of improvement by the General Government. (See Appendix C 22.)

4. Preliminary examination of Bass River, Massachusetts.—The report of Captain Bixby upon this examination was submitted under date of May 31, 1895. It is his opinion, concurred in by the division engineer and by this office, that Bass River is not at present worthy of improvement by the General Government. (See Appendix C 23.)

5. Preliminary examination of Hyannis Harbor, Massachusetts.—The report of Captain Bixby upon this examination was submitted under date of May 31, 1895. This harbor is at present under improvement by the United States; but for the reasons given it is the opinion of Captain Bixby, concurred in by the division engineer and by this office, that the locality is worthy of further improvement by the General Government. It is estimated that the survey necessary to preparation of project and plan of improvement with estimates will cost $600. (See Appendix C 24.)

6. Preliminary examination of Conanicut Island, Rhode Island, with a view of cutting a channel through the same.—The report of Captain Bixby on this examination was submitted under date of May 31, 1895. It is his opinion, concurred in by the division engineer and by this office, that the cutting of a channel across Conanicut Island is an improvement not worthy of being undertaken by the General Government at present. (See Appendix C 25.)

7. Preliminary examination of Seaconnet Point, Rhode Island.—The report of Captain Bixby upon this examination was submitted under date of May 31, 1895. It is his opinion, concurred in by the division engineer and by this office, that this locality is worthy of improvement by the General Government. The amount necessary for a proper survey and report, including project and estimate of cost of improvement proposed, is estimated at $600. (See Appendix C 26.)

8. Survey of Woods Hole and Little Woods Hole Harbor, Massachusetts.—The report of the results of this survey was submitted by Lieutenant Harts under date of August 17, 1895. The project presented contemplates improving the channel connecting Great Harbor, Woods Hole with Buzzards Bay and its southern branch so as to afford a width of 300 feet and a low-water depth of 13 feet. The estimated cost of this improvement is $396,000, provided means are at hand for prompt and continuous conduct of the work, requiring a probable expenditure of about $100,000 each working season until completed. Lieutenant Harts states that smaller appropriations will materially increase the ultimate cost of the work.

No further work by the United States in Little Harbor is now deemed necessary or advisable. (See Appendix C 27.)

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9. Survey of Wickford Harbor, in Narragansett Bay, Rhode Island.—The report of the results of this survey was submitted by Lieutenant Harts, under date of September 4, 1895. The improvement proposed contemplates removal of six bowlders at the harbor entrance and in the channel by blasting, if necessary, and to dredge the channel 60 feet wide and 9 feet deep, with enlargements at the bends up to the highway bridge. The estimated cost of this work is $6,300, provided the whole amount is appropriated in one sum. (See Appendix C 28.)

The local engineer was also charged with the duty of making surveys of—

1. Tarpaulin Cove, Naushon Island, Massachusetts.

2. Stonington Harbor, Connecticut.

3. Pawcatuck River, with reference to its further improvement from Westerly, R. I., to Stonington, Conn.

The reports of the results of these surveys will be duly submitted when received.

IMPROVEMENT OF CONNECTICUT RIVER, MASSACHUSETTS AND CONNECTICUT; OF RIVERS AND HARBORS ON LONG ISLAND SOUND, CONNECTICUT AND NEW YORK, AND ON SOUTHERN SHORE OF LONG ISLAND, NEW YORK.

This district was in the charge Col. Henry M. Robert, Corps of Engineers, having under his immediate orders Lieut. W. E. Craighill, Corps of Engineers.

1. Mystic River, Connecticut.—This is a tidal river about 4 miles in length, extending northward from Fishers Island Sound. Its natural depth for the lower 2 miles was 15 feet or more at low tide, in a very crooked and narrow channel; thence for a mile farther, to the village of Mystic, the depth shoaled to about 9 feet.

Above Mystic there has been little navigation. In 1888 an examination of the river was made, and subsequently a project was adopted for dredging to carry the depth of 15 feet at mean low water, with width of 100 feet, up to the highway bridge, and to widen five bends in the stream at an estimated cost of $30,000.

Up to July 1, 1894, $19,729.61 had been expended on this improvement in dredging to make an available depth of 15 feet at mean low water up to Mystic, where the previous depth had been 9 feet; the widening of the upper two of the five bends had been completed, and the bend at the mouth of the river had been widened by from 25 to 100 feet.

During the past fiscal year the width at the lower bend was further increased opposite the Noank shipyards, and the channel there is now from 150 to 300 feet wide. Dredging at this bend has uncovered a ledge rock with about 9 feet least depth. An improvement of the channel, sufficient for present needs, can be made without removing the rock.

The total amount appropriated for this improvement is $23,500.

Future appropriations will be applied to dredging to maintain or widen the channel, mainly at the lowest bend.

July 1, 1894, balance unexpended	$270.39
Amount appropriated by act of August 17, 1894	3,500.00
	3,770.39
June 30, 1895, amount expended during fiscal year	3,598.40
July 1, 1895, balance unexpended	171.99

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Amount (estimated) required for completion of existing project.....	$6,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	3,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D 1.)

2. Thames River, Connecticut.—This river is a tidal stream extending from the city of Norwich, 15 miles south, to Long Island Sound. For 11 miles above its mouth the depth ranges from 13 to 80 feet.

Until 1889 improvements were confined to a stretch of 3½ miles below Norwich, in which the most troublesome bars lay. In 1829 the channel depth over these bars was about 6 feet at mean low water.

In 1836 a project was adopted for making a channel 100 feet wide and 14 feet deep at mean high water (11 feet at low water) by dredging and by building piers.

In 1878 a channel 14 feet deep at low water was projected, and in 1882 a modification was adopted providing for a channel 200 feet wide and 14 feet deep at mean low water, to be obtained by dredging and by building five dikes or training walls along the outer sides of the channel curves. The estimated cost was $208,080, and a balance of $20,000 from previous appropriations was then available. In 1888 the project was extended to include making 16 feet depth as far as Allyn Point, and 14 feet from there to Easter Point, at an additional cost of $40,000.

Under the provisions of the river and harbor act of July 13, 1892, $10,000 of the appropriation for Thames River was authorized to be expended in the improvement of Shaws Cove, New London, and the total estimated cost of this additional work, $48,000, has been added to the estimate required for completion of the existing project for the improvement of the river. The original depth in this cove was from 2½ to 8 feet at mean low water, and the channel was narrow and crooked. The project provides for making a channel 100 feet wide and 12 feet deep, with an anchorage basin of the same depth about 800 by 400 feet.

The present project, therefore, consists in making and maintaining by dredging and a system of training walls a channel 200 feet wide from New London to Norwich, to be 16 feet deep at mean low water up to Allyn Point (about 5 miles below Norwich), and thence to Norwich to be 14 feet deep, together with dredging in Shaws Cove, New London, to make and maintain a channel 100 feet wide and 12 feet deep and an anchorage basin of the same depth and of about 7½ acres area.

Up to July 1, 1894, three of the proposed dikes had been completed, and the fourth nearly so, and the projected channel was practically completed to within 3 miles of Norwich; thence for about 1½ miles the channel had been made 14 feet deep and 100 feet wide to the "Sand Pier," from which point to Norwich the available depth was 12 feet. The channel in Shaws Cove had been made the full length and depth, with 60 feet width, and the anchorage basin had been begun.

The total amount expended on this improvement to July 1, 1894, was $401,338.96.

During the past fiscal year contracts for dredging in the river near Norwich and in Shaws Cove have been entered into, under which work is about to begin. They will result in further widening and deepening the channel near Norwich and in enlarging the anchorage basin in Shaws Cove.

The total amount appropriated for this river, including Shaws Cove, since 1821 is $416,800.

Future appropriations will be applied to completing and maintaining these channels by dredging.

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July 1, 1894, balance unexpended	$2,961.04
Amount appropriated by act of August 17, 1894	12,500.00
	15,461 04
June 30, 1895, amount expended during fiscal year	38.63
July 1, 1895, balance unexpended	15,422.41
July 1, 1895, amount covered by uncompleted contracts	10,900.00
July 1, 1895, balance available	4,522.41

Amount (estimated) required for completion of existing project	81,100.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	12,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix D 2.)

3. Connecticut River, Massachusetts and Connecticut.—Above Hartford.—From Holyoke, Mass., 34 miles above Hartford, down to Enfield Falls or Rapids, a distance of 18 miles, there is a fair channel 4 to 5 feet deep.

Enfield Rapids extend about 5 miles over a rocky and uneven bed, with a total fall of 32 feet. From the foot of Enfield Rapids to Hartford, a distance of 11 miles, the river's bed is broad and sandy, with a channel from 2 to 5 feet deep at low water.

Several years ago the Connecticut River Company constructed a small canal around Enfield Rapids, through which boats of 3 feet draft and 80 feet length can pass.

The several projects under which work has been done have been for dredging at Barbers Landing and for wing dams. In 1878 plans and estimates were submitted for construction of a canal 8 feet deep around Enfield Rapids. These estimates were revised in 1880. The estimated cost of the canal was $1,322,805. It was not considered advisable to commence construction with a less sum than $450,000, which has not yet been appropriated. There is not now, therefore, any definite project for further improvement of this section of the river.

Up to the close of the present fiscal year $100,000 has been appropriated for this part of the river, of which $91,059.70 has been expended. All the work done has been dredging and the construction and repair of seven wing dams.

No work has been done during the past fiscal year.

The last appropriation for this part of the river was made in 1880 and the last work done was repair of wing dams in 1886. Except the fixing and defining of the channel by wing dams, the results of the improvement so far made have not been permanent.

The funds on hand from previous appropriations are sufficient for such repairs and temporary improvement as may be needed during the ensuing fiscal year. No other work is at present contemplated.

July 1, 1894, balance unexpended	$8,940.30
July 1, 1895, balance unexpended	8,940.30

Connecticut River below Hartford.—Between Hartford and Long Island Sound, a distance of 50 miles by course of channel, the depth on the bars was formerly 5 feet at low water, the worst places being between Hartford and Middletown, a distance of 19 miles, and at Saybrook Bar at the mouth of the river. Dredging was carried on and small wing dams were constructed by private parties and by a State corporation up to 1868, with no permanent benefit.

In 1868 a project for improvement by the United States was submitted, under which a pile dike was built at Hartford, and annual dredging done on the bars below Hartford until 1883.

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In 1873 a project for the construction of three jetties on Saybrook Bar was adopted. Two of these have been built; the third will probably not be required.

In 1880 a project for permanent improvement of six of the worst bars between Hartford and Middletown was adopted. It contemplated building riprap wing dams, rectifying the banks, and protecting the caving banks by mattresses, at a total estimated cost of $330,487. It was afterwards found necessary to extend the project to include annual dredging at these and other bars and the extension and repairs of the Saybrook jetties.

Two of the contemplated works have been built, a training wall at Hartford Bar and a wing dam at Glastonbury Bar, their total cost being $40,715.34. In addition to the work included in the estimate of $330,487, the east and west jetties at Saybrook have been extended and repaired, and a channel 130 feet wide and 12 feet deep has been dredged between them, and from $5,000 to $10,000 has been annually expended in dredging to maintain a depth of 9 feet on the bars between Hartford and Saybrook.

Experience has shown that, on account of the frequency and height of freshets in this river, the permanent works projected in 1880 would be inadequate to maintain the desired depth or even to materially reduce the amount of dredging annually required. Therefore in December, 1887, a new project was adopted confining future operations to the completion of the Saybrook jetties to a height of 5 feet above high water, with a top width of 6 feet, and widening the channel between the jetties to 400 feet, with a depth of 12 feet at mean low water, at an estimated cost of $80,000, with annual dredging to maintain a 9-foot channel between Hartford and Long Island Sound, at an average cost of $10,000 per year. In 1890 an extension of the project was adopted to provide for raising the Hartford Dike to about 15 feet above low-water level, at an additional estimated cost of $50,000, making the total estimated cost for the revised project now in force $130,000 for permanent work and $10,000 annually for maintaining the navigable channel by dredging.

The existing project for improvement, therefore, now consists in making a channel from Long Island Sound to Hartford, Conn., to be 400 feet wide and 12 feet deep at mean low water across Saybrook Bar, and thence to Hartford to be 100 feet wide (or as nearly that as practicable) and 9 feet deep at extreme low water, or about 10 feet below ordinary summer level; these channels to be maintained by annual dredging, by enlarging the breakwaters at Saybrook Bar, and by raising the Hartford Dike. The estimated cost is:

For permanent work	$130,000
For maintenance by annual dredging per year	10,000

And the annual dredging is regarded as the most important of these.

Under the existing project, up to July 1, 1894, no permanent work had been done, the available funds having been required for dredging to maintain the navigable channel.

Of the permanent works built before the adoption of the existing project (in 1887) the Hartford Dike and jetties at Saybrook are in good condition; the jetties have secured the permanence of the entrance channel and the dike has partly secured the channel at Hartford Bar; the Glastonbury Dike is mostly covered by sand. The channel at the entrance retains nearly full width and depth.

The total amount expended by the United States for this improvement from its beginning, in 1836, to July 1, 1894, including liabilities then outstanding, was $435,346.02.

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During the fiscal year dredging was done to maintain the navigable channels in the river, and work is now in progress removing the shoals which formed during the spring freshets. The appropriation of 1894 has been and will be applied wholly to annual maintenance of channels, and will not reduce the estimate for completion of permanent work. Dredging early in each year to restore the channels filled by spring freshets is imperatively necessary for the commerce of this river and should be done whenever funds are available in preference to the projected permanent improvements. Since this part of the project has been definitely adopted and put in practice the river has been on the average in much better navigable condition than before.

Future appropriations will be applied to the maintenance of the 9-foot channels necessary for navigation of the river, to raising the Hartford Dike and completing the Saybrook jetties, and to widening the channel at Saybrook Bar.

July 1, 1894, balance unexpended		$7,806.76
Amount appropriated by act of August 17, 1894		20,000.00
		27,806.76
June 30, 1895, amount expended during fiscal year		5,561.88
July 1, 1895, balance unexpended		22,244.88
July 1, 1895, outstanding liabilities	$5,103.34	
July 1, 1895, amount covered by uncompleted contracts	4,072.05	
		9,175.39
July 1, 1895, balance available		13,069.49
Amount (estimated) required for completion of existing project		130,000.00
Amount (estimated) required for maintenance annually		10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix D 3.)

4. Harbor of refuge at Duck Island Harbor, Connecticut.—This harbor is a broad bay, on the north side of Long Island Sound, about midway between the harbors of New Haven and New London, a distance of 46 miles in the widest part of the Sound, where there is no sufficient harbor of refuge for general commerce. Duck Island Harbor is large enough for such use, but is naturally unprotected from storms from any southerly quarter.

By order of Congress examinations of this harbor were made in 1883 and 1886, and subsequently a project was adopted for making it a harbor of refuge, by constructing three riprap breakwaters, the west one extending westerly from Duck Island, the middle one extending northeasterly from Duck Island, the east one extending southwesterly from Menunketesuck Point, the east limit of the harbor. The total length of these breakwaters was to be 5,880, feet and their estimated cost is $463,540.

Work under this project was begun in May, 1891, and up to July 1, 1894, 1,660 linear feet of the west breakwater had been built, extending it westwardly from Duck Island into a depth of about 16½ feet at mean low water. Part of this work has settled, and requires building higher. At its present length the breakwater affords a limited shelter from southeast and south storms.

During the past fiscal year a contract for raising and extending the breakwater has been entered into, but work is not yet begun.

The total amount appropriated for this improvement is $90,000.

Future appropriations will be applied to continuing breakwater construction.

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July 1, 1894, balance unexpended		$1,640.68
Amount appropriated by act of August 17, 1894		30,000.00
		31,640.68
June 30, 1895, amount expended during fiscal year		1,562.04
July 1, 1895, balance unexpended		30,078.64
July 1, 1895, outstanding liabilities	$22.00	
July 1, 1895, amount covered by uncompleted contracts	25,840.00	
		25,862.00
July 1, 1895, balance available		4,216.64
Amount (estimated) required for completion of existing project		373,540.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		30,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix D 4.)

5. New Haven Harbor, Connecticut.—The original available low-water depth up to the wharves in this harbor was about 9 feet.

The first project for deepening the channel provided for making it 13 feet deep, which was done in 1871. It was widened at different times until 1878, when a project was adopted for dredging a channel 16 feet deep and not less than 400 feet wide. In 1889 a project was adopted for building a dike to extend out from Sandy Point, with an arm parallel to the channel and 3,200 feet long, in order to contract the channel and maintain 16 feet depth on Fort Hale Bar when that depth should be obtained by dredging.

In 1887 a revised estimate placed the cost of completion of the project at $47,000 for dredging the channel through Fort Hale Bar, and $46,000 for completing the dike; total, $93,000.

Up to July 1, 1894, the shore arm and 2,089 feet of the channel arm of the Sandy Point Dike had been built; a 16-foot channel from 400 to 700 feet wide had been made and maintained all the way up the harbor to Tomlinson's bridge, except over the Fort Hale Bar, where the depth is but 13 feet.

During the past fiscal year a contract for dredging a channel through Fort Hale Bar, to be 16 feet deep and about 100 feet wide, has been made, under which work is soon to be begun.

The total amount appropriated for improving this harbor since the beginning of work in 1867 is $316,000.

Future appropriations will be applied to dredging and, if necessary, to extending the dike.

July 1, 1894, balance unexpended		$179.11
Amount appropriated by act of August 17, 1894		10,000.00
		10,179.11
June 30, 1895, amount expended during fiscal year		99.38
July 1, 1895, balance unexpended		10,079.73
July 1, 1895, amount covered by uncompleted contracts		9,000.00
July 1, 1895, balance available		1,079.73
Amount (estimated) required for completion of existing project		38,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix D 5.)

6. Breakwaters at New Haven, Conn.—In 1880 a project was adopted for making a harbor of refuge at the entrance of New Haven Harbor by construction of two riprap breakwaters; the first to be 3,300 feet

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long, extending northeasterly from the light-house on Southwest Ledge to Quixes Ledge; the second to be 4,200 feet long, extending northwesterly from Luddington Rock. The estimated cost was $1,311,134.

The river and harbor act of August 11, 1888, making appropriation for continuing this improvement, provided:

> And the Chief of Engineers may, if deemed necessary, relocate the western breakwater, and the Secretary of War is authorized, in his discretion, to expend any portion of said sum in commencing its construction.

The New Haven harbor commissioners proposed a plan for relocation of the western breakwater which would largely increase the anchorage afforded under the original project and which would cost about $5,000,000.

There was no doubt of the desirability of increasing the anchorage ground, but the expenditure required by this plan was larger than the present demands of commerce seemed to warrant. A plan was suggested by the officer in charge for changing the location of the western breakwater to the southwest about 6,000 feet, and constructing a breakwater 5,000 feet long, which should start at a point 1,000 feet north 54° east from Luddington Rock, and extend south 54° west, crossing the rock; also for constructing a smaller breakwater from the east shore toward Quixes Ledge to better protect the harbor from easterly storms, leaving an eastern entrance channel 800 feet wide and 13 feet deep. The cost of these works in addition to the estimates of $1,311,134 would be about $840,000, making the total cost from the beginning $2,151,134.

Upon appropriation of $120,000 by the river and harbor act of 1890, the modifications of project above described were adopted. Further details concerning this plan, and a sketch showing location of proposed works, are printed in the Annual Report for 1889, Part I, pages 60 and 61; also Appendix D 6, pages 675–685.

Up to July 1, 1894, the east breakwater, 3,450 feet long, had been completed, affording considerable shelter to the east side of the harbor, and 3,166 feet of the middle breakwater, overlying Luddington Rock, had been built, though not to full cross section.

During the past fiscal year the middle breakwater has been extended 675 feet, making its total length 3,841 feet; the depth at the west end of the work is 25 feet at mean low water. At their present lengths the breakwaters afford shelter from southeast storms to more than half the harbor entrance.

The total amount appropriated for this project since its commencement is $735,000.

Under a contract not yet completed the middle breakwater will be extended nearly to the projected length. Future appropriations will be applied to completing this breakwater, both as to length and cross section, and to constructing the other breakwaters contemplated in the approved project.

July 1, 1894, balance unexpended		$2,731.02
Amount appropriated by act of August 17, 1894		125,000.00
		127,731.02
June 30, 1895, amount expended during fiscal year		36,881.82
July 1, 1895, balance unexpended		90,849.20
July 1, 1895, outstanding liabilities	$5,222.66	
July 1, 1895, amount covered by uncompleted contracts	73,234.48	
		78,457.14
July 1, 1895, balance available		12,392.06

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Amount (estimated) required for completion of existing project	$1,416,134.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	125,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix D 6.)

7. *Housatonic River, Connecticut.*—The navigable part of the river extends from Derby, Conn., to Long Island Sound, a distance of 13 miles, and was originally obstructed by several bars upon which the low-water depth was from 3 to 5 feet.

In 1871 a project was adopted for making a channel 7 feet deep at mean low water and from 150 to 200 feet wide, by dredging and rock removal and by building a dike in the river and a breakwater to protect the channel across the outer bar, at a total estimated cost of $404,961.

This project was modified in 1887 to reduce the width of channel in the river to 100 feet and to fix the length of the proposed breakwater at 5,750 feet, and the estimate for completion was revised, making it then $202,000, or from the beginning in 1871, $275,500. The annual cost of maintenance of channels was estimated at $4,000.

Up to July 1, 1894, Drews Rock had been removed, a jetty had been built at Sow and Pigs Reef, the breakwater at the river's mouth had been made 5,025 feet long, and channels of the required depth had been several times dredged.

During the past fiscal year the breakwater has been further extended 300 feet, making its total length 5,325 feet.

With the remainder of the available funds the breakwater is to be further extended under a contract now in force, and dredging will be done, if necessary, over the several bars in the river.

The total amount appropriated for improving this river since the beginning of work in 1871 is $188,500.

Future appropriations should be applied mainly to extending and enlarging the breakwater and to dredging.

July 1, 1894, balance unexpended		$1,435.00
Amount appropriated by act of August 17, 1894		25,000.00
		26,435.00
June 30, 1895, amount expended during fiscal year		4,273.65
July 1, 1895, balance unexpended		22,161.35
July 1, 1895, outstanding liabilities	$5,382.83	
July 1, 1895, amount covered by uncompleted contracts	7,415.27	
		12,798.10
July 1, 1895, balance available		9,363.25

Amount (estimated) required for completion of existing project	87,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	25,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix D 7.)

8. *Bridgeport Harbor, Connecticut.*—The available depth in this harbor was originally 5 feet at mean low water.

The first project for improvement provided for an 8-foot channel over the outer and inner bars. This was dredged on the outer bar in 1837, and on both bars in 1853. In 1871 a project was adopted for making a channel 12 feet deep and 100 feet wide, subsequently modified to 300 feet, and for building a jetty on the east shore to check the influx of sand.

This was accomplished in 1882, and a new project was adopted for widening to 600 feet the channel from the Inner Beacon to the Nauga-

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tuck Railroad wharf, to provide for vessels driven in by bad weather without blocking the main channel. The estimated cost of the latter project was $60,000; it is very nearly completed. A small area remains near the Inner Beacon which it is considered desirable to dredge. The project was extended in 1888 to include widening the channel above the railroad wharf in order to relieve the crowding at that point, and was further extended by act of Congress authorizing the expenditure of the appropriation of 1888 toward dredging a 9-foot channel up to the head of the upper harbor above the bridges, and by the river and harbor act of 1890, which directed the beginning of the breakwater from the Tongue to the Inner Beacon. The total estimated cost of these extensions was $65,000, of which $40,000 has been appropriated.

Under authority of the river and harbor act of 1894 the project was further extended to provide for making a channel over the outer bar 100 feet wide and 15 feet deep. It is believed, however, that the estimate for completion, $25,000, is still sufficient.

The present project for this improvement, as modified and extended, contemplates a channel 12 feet deep and 300 feet wide or more from Long Island Sound to the lower bridge, with a channel 100 feet wide and 15 feet deep over the outer bar; a channel 9 feet deep and 100 feet wide above the lower bridge; a breakwater or jetty on the east shore (completed), and a breakwater from the Tongue to the Inner Beacon.

Up to July 1, 1894, the breakwater on the east shore had been completed, a channel 12 feet deep at mean low water had been dredged to the lower bridge with width of 200 to 300 feet, and with additional width of 470 feet between the Tongue and the Inner Beacon (total 770 feet) for anchorage; at the outer bar and immediately below the bridge shoaling had reduced the width of the 12-foot channel to about 75 feet. Above the lower bridge and practically to the head of navigation the channel was 9 feet deep at mean low water with from 60 to 90 feet width. The breakwater from the Tongue to the Inner Beacon had been built its full length, 1,165 feet, but not to the full cross section considered necessary for permanence; it afforded a shelter of value to the anchorage ground and to the lower wharves.

During the past fiscal year dredging has been done to make the channel 100 feet wide and 15 feet deep over the outer bar. This channel will be completed under a contract now in progress. The survey of the harbor intended for a new project of improvement and authorized by the river and harbor act of 1894 was made and the map is nearly completed.

The total amount appropriated for this harbor since the beginning of work by the United States in 1836 is $292,485.38.

The completion of the existing project includes extending and widening the channel above the horse railroad bridge, removing shoals from the harbor channel, and enlarging the breakwater, at an estimated cost of $25,000.

July 1, 1894, balance unexpended		$344.40
Amount appropriated by act of August 17, 1894		10,000.00
		10,344.40
June 30, 1895, amount expended during fiscal year		3,618.21
July 1, 1895, balance unexpended		6,726.19
July 1, 1895, outstanding liabilities	$3,437.23	
July 1, 1895, amount covered by uncompleted contracts	2,477.33	
		5,914.56
July 1, 1895, balance available		811.63

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Amount (estimated) required for completion of existing project	$25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D 8.)

9. Black Rock Harbor, Connecticut.—This harbor consists of a bay partly sheltered by Fayerweather Island and of two small streams extending inland from the head of the bay. The depth in Cedar Creek, the more important of these streams, was from 2 to 4 feet at mean low water, and the channel was narrow and very crooked.

The project for improvement, submitted in 1883 and adopted in 1884, included dredging a channel 3,300 feet long, 80 feet wide, and 6 feet deep, to extend up Cedar Creek, and a breakwater from Fayerweather Island to the mainland. The estimated cost was $80,000.

Up to July 1, 1894, the channel had been made of the full projected dimensions and the breakwater had been built to the full length, but with reduced cross section. The project was considered completed in 1894, as the further enlargement of the breakwater appeared unnecessary at that time. The old sea wall on Fayerweather Island, considerably damaged by the severe storms of 1893–94, had been partly repaired.

During the past fiscal year further repairs were made to the old sea wall. The parts recently repaired are in good condition, but further work is necessary to insure the safety of the structure.

The total amount appropriated for this harbor since the beginning of improvement in 1884 is $47,500.

No appropriation is needed for the ensuing year.

July 1, 1894, balance unexpended	$305.19
Amount appropriated by act of August 17, 1894	2,500.00
	2,805.19
June 30, 1895, amount expended during fiscal year	2,805.19

(See Appendix D 9.)

10. Saugatuck River, Connecticut.—This river is a tidal stream extending inland about 4½ miles by course of channel from Long Island Sound to Westport, Conn. It has a natural depth of 5 feet at mean low water, in a rather narrow, crooked channel, up to the railroad bridge at Saugatuck, about 3 miles from the Sound; thence the depth decreases gradually until at Westport it is less than 1 foot. The channel is somewhat obstructed by rocks in its upper part.

From 1826 to 1838 a short breakwater was built on Cedar Point, the east side of the river's mouth, to prevent sand obstructing the entrance; the work was repaired and extended in 1870. In 1836–1840 a canal was cut through "Great Marsh" to shorten the sailing course to the westward; since 1850 it has been so filled up as to be of little use.

Under the terms of the river and harbor act of 1892 a project was adopted providing for deepening the channel to the village of Westport, making it 60 feet wide and 4 feet deep at mean low water, at an estimated cost of $10,000.

Up to July 1, 1894, the channel had been made 4 feet deep nearly to the Westport bridge with width of 40 to 60 feet. The breakwater at Cedar Point needed some repair; the canal was seldom used, being passable at high tide for light-draft vessels only.

During the past fiscal year no work has been done. The presence of bowlders in line of the channel makes an examination necessary before a contract can be let.

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The total amount appropriated for Saugatuck River under the existing project is $10,000, and the balance available is considered sufficient to complete the project during the ensuing year.

July 1, 1894, balance unexpended	$878.95
Amount appropriated by act of August 17, 1894	3,000.00
	3,878.95
June 30, 1895, amount expended during fiscal year	1.80
July 1, 1895, balance unexpended	3,877.15

(See Appendix D 10.)

11. Norwalk Harbor, Connecticut.—This harbor consists of the tidal part of Norwalk River, extending from Norwalk, Conn., to the river's mouth, a distance of about 3 miles. South Norwalk is on the west bank of the river, about 1½ miles below Norwalk. Originally the depth up to South Norwalk was about 5 feet at mean low water; between there and Norwalk the river bed ran nearly bare.

The first project for improvement contemplated a channel 100 feet wide and 6 feet deep to Norwalk. In 1881 the project was modified to provide for a depth of 8 feet below South Norwalk. During the progress of the work some parts of the channel required dredging several times. The last estimate of cost of this work, from beginning to end, was $84,000.

In 1892 the project was reported completed. The estimated amount of money required had been appropriated and expended, and the channel had been made 8 feet deep and 100 feet wide up to South Norwalk, and thence to Norwalk 6 feet deep and from 60 to 100 feet wide. It was constantly used by vessels freighting to Norwalk and South Norwalk, to which it was indispensable.

The river and harbor act of 1894 appropriated $15,000 for improving Norwalk Harbor, and indicated the points where work should be done. In accordance therewith a project was adopted for expenditure of the available funds in removing the shoal at Ferrys Point, near Norwalk, and if any balance remained, in widening the bend near Keysers Island at the mouth of the harbor. A contract for this work has been made, and dredging will be begun early in the ensuing year.

The total amount appropriated for this harbor from 1872 to the present date is $98,000.

The existing project being merely for the expenditure of the available funds, nothing further is required for its completion. The river and harbor act of 1894 ordered a survey of Norwalk Harbor under which plans for continuation of this improvement will be considered.

Amount appropriated by act of August 17, 1894	$15,000.00
June 30, 1895, amount expended during fiscal year	799.28
July 1, 1895, balance unexpended	14,200.72
July 1, 1895, amount covered by uncompleted contracts	12,155.00
July 1, 1895, balance available	2,045.72

(See Appendix D 11.)

12. Wilsons Point Harbor, Connecticut.—This harbor is a bay on the north shore of Long Island Sound, sheltered from all storms except southerly ones. Its natural depth of 16 feet at the mouth shoaled to about 5 feet at low water at the wharves of the New England Terminal Company, a corporation formed to secure water privileges for the Housatonic Railroad system and its connections.

In 1888 $25,000 was appropriated for this improvement as a part of Norwalk Harbor, and a project was adopted for making a channel 300

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feet wide and 15 feet deep up to the vicinity of the wharves. The required depth was secured with width of 400 feet.

In 1890 $30,000 was appropriated for this harbor, and up to July 1, 1892, with a total expenditure of $53,676.90, the channel up to the vicinity of the wharves had been made 15 feet deep at mean low water, and about 700 feet wide, with an additional width of 200 feet for 750 feet on the east side near the wharves. The 15-foot channel was also extended northward, parallel to and 75 feet west of the wharves, with width of 200 feet. This permitted vessels of 15 feet draft to approach the wharves at any ordinary stage of tide, and the project was reported completed in 1892.

July 1, 1894, the dredged channels were in good condition.

Nothing was done during the past fiscal year.

No further improvement at this point is needed and no further appropriation is required.

July 1, 1894, balance unexpended	$1,323.10
June 30, 1895, amount expended during fiscal year	500.00
July 1, 1895, balance unexpended	823.10

(See Appendix D 12.)

13. Five Mile River Harbor, Connecticut.—This harbor is a small inlet over a mile long and from 300 to 800 feet wide, on the north shore of Long Island Sound. The natural low-water depth at the mouth is about 3 feet, shoaling to zero halfway up the harbor.

The project for improvement proposed in a report on a survey made in 1886, and adopted under an appropriation of $5,000, made August 11, 1888, provides for dredging a channel 8 feet deep at mean low water, 100 feet wide, and about 6,000 feet long, extending to the head of the harbor. The estimate of cost of this work from the beginning, as revised in 1894, is $45,000.

The total amount appropriated for this improvement is $17,500. Up to July 1, 1894, $14,665.85 had been expended, and a channel 60 feet wide and 3,580 feet long had been dredged to a depth of 8 feet at mean low water, extending from Long Island Sound to the vicinity of the wharves. A contract for dredging is now in force, under which during the ensuing year the channel will be extended farther up the harbor.

Future appropriations will be applied to widening and extending the channel as projected.

July 1, 1894, balance unexpended	$334.15
Amount appropriated by act of August 17, 1894	2,500.00
	2,834.15
June 30, 1895, amount expended during fiscal year	3.85
July 1, 1895, balance unexpended	2,830.30
July 1, 1895, amount covered by uncompleted contracts	1,975.00
July 1, 1895, balance available	855.30
Amount (estimated) required for completion of existing project	27,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	2,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D 13.)

14. Stamford Harbor, Connecticut.—This harbor consists of a bay, on the north shore of Long Island Sound, and of two tidal inlets, known as the East and West branches, extending up to the city of

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Stamford. The original depth in the West Branch was from 1 to 3 feet, gradually increasing in the bay to a depth of 12 feet; the East Branch was originally a small marshy creek, deepened by private dredging to a depth of about 8 feet at mean low water.

The project of improvement adopted in 1886 provided for dredging a 5-foot channel 80 feet wide up to the head of the West Branch. This was accomplished in 1892. In that year a project was adopted providing for enlarging the channel of the West Branch to 150 feet width and 7 feet depth, and dredging out the basin between the harbor lines at the head of this branch; also for making the channel of the East Branch 100 feet wide for a length of 8,535 feet, and 50 feet wide for a length of 1,200 feet, with depth of 9 feet, at a total estimated cost of $123,500.

July 1, 1894, the channel of the East Branch had been made 60 feet wide and 9 feet deep, or nearly so, up to the steamboat dock, with slightly less depth and width above, to the head of navigation. Nothing had been done in the West Branch under the project of 1892 except a small amount of dredging on two shoals.

During the past fiscal year a few bowlders were removed from the edge of the channel of the East Branch under a balance of the appropriation of 1892, and a contract has been entered into for dredging in both sides of the harbor, under which work has not yet been begun.

The total amount appropriated for this harbor since the beginning of improvement in 1886 is $45,000, of which $25,000 has been or will be applied to the existing project.

Future appropriations will be applied to widening and deepening the channel as projected.

July 1, 1894, balance unexpended	$726.29
Amount appropriated by act of August 17, 1894	10,000.00
	10,726.29
June 30, 1895, amount expended during fiscal year	716.32
July 1, 1895, balance unexpended	10,009.97
July 1, 1895, amount covered by uncompleted contracts	9,000.00
July 1, 1895, balance available	1,009.97
Amount (estimated) required for completion of existing project	98,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D 14.)

15. Harbor at Cos Cob and Mianus River, Connecticut.—This harbor is a small inlet on the north shore of Long Island Sound, extending inland about 2 miles to the village of Mianus. The natural low-water channel was rather narrow and bordered by mud flats, with a depth of 12 feet or more at the entrance, decreasing to about 4 feet just below the railroad bridge, halfway up the inlet, and thence to Mianus, decreasing to less than 2 feet.

The project for improvement, adopted in 1892, provides for dredging to make a channel 6 feet deep at mean low water, with 150 feet width to the railroad bridge, and thence to Mianus 100 feet wide, estimated to cost $36,000.

Up to July 1, 1894, the channel had been made 150 feet wide and 6 feet deep at mean low water up to the railroad bridge.

The river and harbor act of 1894 appropriated $4,000 for continuing the improvement and for a survey with a view to making a turning

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basin. The survey has been made and a contract for dredging has been entered into, but work under it has not yet begun.

The total amount appropriated for this improvement is $11,000.

With the available funds the dredged channel will be extended above the railroad bridge; future appropriations will be applied to further extension of the channel, as projected.

July 1, 1894, balance unexpended	$417.53
Amount appropriated by act of August 17, 1894	4,000.00
	4,417.53
June 30, 1895, amount expended during fiscal year	389.60
July 1, 1895, balance unexpended	4,027.93
July 1, 1895, amount covered by uncompleted contracts	3,069.00
July 1, 1895, balance available	958.93
Amount (estimated) required for completion of existing project	25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	4,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D 15.)

16. Port Chester Harbor, New York.—This harbor, at the boundary between the States of New York and Connecticut, consists of a bay opening into Long Island Sound at the mouth of Byram River and of the lower part of the river itself, which is navigable for about a mile above its mouth.

The original available depth in the river was not more than a foot at low water, and Salt Rock in the river and Sunken Rock in the bay were considered dangerous obstructions.

The project for improvement, adopted in 1871, provided for the removal of these rocks to 9 and 11 feet depth, respectively, and for the construction of a breakwater at Byram Point, at the mouth of the harbor, the estimated cost being $96,632.

In 1884 the project was extended to provide for dredging a channel 2½ feet deep and from 60 to 100 feet wide from the bay to the vicinity of the village wharves.

In 1888 the project was further modified to omit the removal of Sunken Rock and to build a breakwater from that rock to Byram Point, which should also serve as a beacon on the rock. A revised estimate, made in 1890, in accordance with the modification, reduced the cost of completion by about $40,000.

Up to July 1, 1894, Salt Rock had been removed to 9 feet depth, a channel 2½ feet deep had been dredged from 60 to 100 feet wide up to within 150 feet of Port Chester bridge and 25 feet wide to the bridge, and the breakwater had been completed to its full length, 855 feet, except the enlargement necessary to make the outer end permanent.

The dredging and rock removal have resulted in admitting safely vessels of greater draft than formerly. The partial completion of the breakwater has served to mark Sunken Rock and to shelter a small anchorage area at the mouth of the river.

During the past fiscal year the outer end of the breakwater was enlarged and dredging was begun, under a contract not yet completed, to deepen the channel in the bay.

Future appropriations will be applied to maintaining the existing work, if necessary, and to enlarging the dredged channel.

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July 1, 1894, balance unexpended		$224.26
Amount appropriated by act of August 17, 1894		5,000.00
		5,224.26
June 30, 1895, amount expended during fiscal year		1,291.44
July 1, 1895, balance unexpended		3,932.82
July 1, 1895, outstanding liabilities	$33.17	
July 1, 1895, amount covered by uncompleted contracts	3,813.47	
		3,846.64
July 1, 1895, balance available		86.18

Amount (estimated) required for completion of existing project	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D 16.)

17. Larchmont Harbor, New York.—This is a bay about half a mile wide and extending three-quarters of a mile inland, with a depth gradually diminishing from 18 feet at and near the mouth. The mouth of the bay was obstructed by two rocks (Umbrella Rock and Huron Rock) always covered, and owing to its width the harbor anchorage was little protected from easterly and southerly storms.

A survey was ordered by Congress in 1888, and afterwards a project was adopted for connecting Umbrella Rock with the west shore and Huron Rock with the east shore by riprap breakwaters, which would sufficiently mark the rocks and would cover the harbor. The estimated cost of the project was $105,000.

Up to July 1, 1894, $4,879.05 had been expended in constructing 74 linear feet of the Umbrella breakwater and 64 linear feet of the Huron breakwater, the location being over the rocks. The breakwaters serve to mark the rocks, but are not long enough to afford any appreciable shelter.

No work has been done during the past fiscal year.

Future appropriations should be applied to completing the breakwaters.

July 1, 1894, balance unexpended	$120.95
July 1, 1895, balance unexpended	120.95

Amount (estimated) required for completion of existing project	100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

(See Appendix D 17.)

18. East Chester Creek, New York.—This is a small tidal stream emptying into Pelham Bay. It was navigable at high tide only, for vessels drawing 7 feet, up to Lockwoods, a distance of 2¼ miles. The rise of tide is 7.1 feet.

The project for improvement adopted in 1872 and subsequently modified provided for a channel 9 feet deep at mean high water, extending to a point 3,000 feet above Lockwoods and terminating at the upper end in a tidal basin. Part of the lower course of the channel was to be protected by dikes, and the whole work was estimated to cost $221,000.

In 1891 this estimate was revised and reduced, omitting the dikes, which then seemed unnecessary for maintaining the channel, and the project for improvement, as revised and modified, consists in making and maintaining a channel 100 feet wide and 9 feet deep at mean high water (about 2 feet at low water), extending from Pelham Bay up the creek 3,000 feet above Lockwoods, and in removing rocky obstructions

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from the mouth of the creek, at an estimated cost from the beginning of $124,000.

Up to July 1, 1894, $69,000 had been appropriated and expended upon this improvement, in dredging and rock removal to make a channel 9 feet deep at high water (2 feet at low water), with width of 125 feet, to the head of Goose Island, one-half mile from the mouth of the creek; thence to Town Dock with width of 100 feet; thence to Lockwoods with nearly the same width; thence for about 1,300 feet above the drawbridge with 60 feet width. Above Town Dock 1,235 linear feet of diking had been built to sustain the sides of the channel.

Under the appropriation of $12,000 in 1894, during the past fiscal year the channel has been dredged to the upper limit of the project with full depth and, excepting a small section, with full width. This section will be completed under the contract now in force.

The channel between Town Dock and Lockwoods has shoaled near the banks, and the present available width is not over 50 feet.

Future appropriations should be applied to removing shoals from the channel and restoring the full width.

Amount appropriated by act of August 17, 1894		$12,000.00
June 30, 1895, amount expended during fiscal year		7,229.86
July 1, 1895, balance unexpended		4,770.14
July 1, 1895, outstanding liabilities	$3,700.98	
July 1, 1895, amount covered by uncompleted contracts	653.04	
		4,354.02
July 1, 1895, balance available		416.12
Amount (estimated) required for completion of existing project		43,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		12,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix D 18.)

19. Greenport Harbor, New York.—This harbor, at the eastern end of Long Island, is exposed to easterly storms. Its anchorage ground, which was sheltered by Joshua Point, has materially shoaled by the erosion of the point and by the influx of drifting sand.

The project of improvement, adopted in 1882, provided for the construction of a riprap breakwater extending from Joshua Point 1,700 feet in a southeasterly course to arrest drifting sand, to check the erosion of the point, and to increase the sheltered area. Its cost was estimated at $46,000.

In 1890 the project was modified to provide for increasing the height of the breakwater from 3 feet above high water to 5 feet instead of extending it, and to apply the rest of the estimated amount for completion to dredging and enlarging the anchorage basin.

Up to July 1, 1894, $46,000 had been appropriated for this work; the breakwater had been completed, and dredging had been done to increase the area of sheltered anchorage and to deepen the entrance to Sterling Basin, a sheltered cove used for wintering vessels. The project was completed in September, 1893.

During the past fiscal year nothing was done.

No further work is proposed, and no additional appropriation is required.

July 1, 1894, balance unexpended	$1,295.77
June 30, 1895, amount expended during fiscal year	11.75
July 1, 1895, balance unexpended	1,284.02

(See Appendix D 19.)

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20. Port Jefferson Harbor, New York.—This harbor is a large and deep inland bay, with a narrow entrance or inlet, outside of which was originally a shoal with 4 feet depth at low water. The location of the inlet is one of the most exposed on Long Island Sound.

Under a project adopted in 1871 and modified in 1873 and 1877 an east jetty 1,390 feet long and a west jetty 940 feet long were built, both with scant cross section, and a channel 8 feet deep and 100 feet wide was dredged through the bar. The work was completed in 1883, at a total cost of $79,000.

By order of Congress an examination of Port Jefferson Inlet was made in 1888, and subsequently a project was adopted for repairing and enlarging the jetties and dredging to make a channel 10 feet deep and 200 feet wide, at an estimated cost of $90,000.

Under this project, up to July 1, 1894, the jetties had been enlarged, though not to the extent required, and the channel had been made the projected depth and width.

The river and harbor act of 1894 appropriated $7,500 for this improvement and directed that it be applied to the project for 12 feet depth, mentioned in the report upon the preliminary examination of 1889. The project was therefore modified accordingly, and now consists in repairing and extending the jetties and in dredging to make a channel 200 feet wide and 12 feet deep at mean low water, at an estimated cost from the beginning, in 1890, of $145,000, of which $42,500 has been appropriated.

During the past fiscal year a contract has been made for dredging a channel 12 feet deep at mean low water and about 100 feet wide through the bar at the harbor entrance. This work is about to be begun and will be completed during the ensuing year.

The total amount appropriated for improvement of Port Jefferson Harbor since work by the United States was begun in 1871 is $121,500, of which $42,500 has been appropriated for the existing project.

Future appropriations will be applied to completing and maintaining the 12-foot channel and to repairing, enlarging, and extending the jetties.

July 1, 1894, balance unexpended	$1,199.01
Amount appropriated by act of August 17, 1894	7,500.00
	8,699.01
June 30, 1895, amount expended during fiscal year	41.55
July 1, 1895, balance unexpended	8,657.46
July 1, 1895, amount covered by uncompleted contracts	7,020.00
July 1, 1895, balance available	1,637.46

Amount (estimated) required for completion of existing project	102,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	7,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D 20.)

21. Huntington Harbor, New York.—This is a tidal inlet, extending southward from Huntington Bay to the village of Huntington. It is about 2 miles long, quite narrow, and landlocked, and has a natural available depth of nearly 8 feet at mean low water up to within three-fourths of a mile of the head of the harbor, where the low-water depth shoaled gradually to zero.

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In 1872–73 a channel 8 feet deep and 150 feet wide was dredged in the upper part of the harbor by the United States at a cost of $22,500. Within ten years following this had nearly filled up.

In 1884 a survey was ordered by Congress, and subsequently a project for improvement was adopted, providing for redredging a channel 8 feet deep and 100 feet wide up to the upper wharves, at an estimated cost of $32,000. The estimate includes also a pile protection for part of the channel, but it seems probable that equally good results can be obtained by applying the funds to dredging a greater width.

Up to July 1, 1894, the 8-foot channel had been dredged 105 feet wide to the bend at the steamboat landing, with width of 185 feet at the bend, and thence to the upper landings 90 feet wide.

During the past fiscal year a contract for dredging has been entered into to widen the channel in the upper harbor. Work under this contract will begin early in the ensuing year.

The total amount appropriated for this harbor since the beginning of work in 1872 is $39,500, of which $17,000 was appropriated for work under the existing project.

Future appropriations will be applied to dredging to maintain and further widen and extend the channel.

July 1, 1894, balance unexpended	$209.99
Amount appropriated by act of August 17, 1894	2,000.00
	2,209.99
June 30, 1895, amount expended during fiscal year	1.50
July 1, 1895, balance unexpended	2,208.49
July 1, 1895, amount covered by uncompleted contracts	1,680.00
July 1, 1895, balance available	528.49
Amount (estimated) required for completion of existing project	15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	2,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D 21.)

22. Glen Cove Harbor, New York.—This harbor is an inlet on the east side of Hempstead Harbor, which is accessible only at high tide, and a breakwater was needed to shelter vessels while at anchor waiting for tides.

The project for improvement, adopted in 1888, provided for a riprap breakwater about 2,500 feet long, extending in a west-southwesterly direction from the northwest corner of the Glen Cove Dock, the top to be 5 feet wide and 3 feet above mean high water, and slopes to be 1 on 1. Its estimated cost was $201,960. In 1895 the project was modified to limit the length of the breakwater to about 2,000 feet, and revised estimates were made, based upon the cost of work already done and reducing the estimate of cost, from the beginning of work in 1888, to $135,000.

Up to July 1, 1894, 1,076 linear feet of the breakwater had been built to nearly full cross section, affording a small area of shelter which enabled vessels to use the main landing in all weather and to lie at anchor securely until the rise of tide made the inner harbor at Glen Cove navigable.

During the past fiscal year the breakwater had been extended 213 linear feet, making its total length 1,289 feet.

Future appropriations will be applied to extending the breakwater as projected.

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July 1, 1894, balance unexpended	$232.23
Amount appropriated by act of August 17, 1894	10,000.00
	10,232.23
June 30, 1895, amount expended during fiscal year	6,970.66
July 1, 1895, balance unexpended	3,261.57
July 1, 1895, outstanding liabilities	2,762.70
July 1, 1895, balance available	498.87
Amount (estimated) required for completion of existing project	80,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D 22.)

23. Flushing Bay, New York.—Before improvement the available depth in this broad, shallow bay, and in the channel leading up to Flushing, was less than 4 feet at mean low water.

The project for improvement, adopted in 1879, contemplated building 16,700 feet of diking to form a tidal basin which, by filling and discharging through the main channel, would maintain a channel depth of 6 feet or more at mean low water, after once dredging. The bottom is soft mud. The estimated cost of this work was $173,500.

In 1888 the project was modified to omit part of the diking, which then appeared unnecessary, and in 1891, at the request of many citizens, the extension of dikes was wholly omitted from the project.

Up to July 1, 1894, 4,663 linear feet of diking had been built, and the channel of 100 feet width and 6 feet depth at mean low water had been dredged and redredged.

During the past fiscal year a contract has been entered into for dredging to maintain and widen the channel. Work under this contract will begin early in the ensuing year.

The total amount appropriated for this improvement is $119,000.

The further work in Flushing Bay consists in repair and maintenance of the dredged channel. It has been found expedient to dredge to a greater depth than 6 feet in order to maintain a depth of 6 feet for more than one season.

July 1, 1894, balance unexpended	$591.25
Amount appropriated by act of August 17, 1894	4,000.00
	4,591.25
June 30, 1895, amount expended during fiscal year	395.27
July 1, 1895, balance unexpended	4,195.98
July 1, 1895, amount covered by uncompleted contracts	3,510.00
July 1, 1895, balance available	685.98
Amount (estimated) required for completion of existing project	54,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	4,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D 23.)

24. Patchogue River, New York.—This is a shallow tidal inlet extending about a mile northward from the shore of Great South Bay, Long Island, to the village of Patchogue. The natural depth in the stream and over a bar at the mouth was from 2 to 3 feet at mean low water and the rise of tide is about 1 foot.

In 1880 and again in 1886 examinations were made by order of Congress, and subsequently a project was adopted for making a channel 6 feet deep at mean low water and 60 feet wide up to the village wharves,

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to be protected at the mouth by a jetty on the west side, at an estimated cost of $40,000.

Up to July 1, 1894, $23,000 had been appropriated for this work, and had been nearly all expended in constructing 1,340 linear feet of jetty and ni dredging a channel 6 feet deep and 50 feet wide from Great South Bay about half way up to the village; inside the mouth of the river the channel is from 50 to 150 feet wide, being enlarged by private work mainly.

The existing channel affords access to the wharves in the lower part of the river, but should be extended to the head of the stream to make it generally useful.

During the past fiscal year no work was done.

The available funds will be applied to dredging during the ensuing year as soon as arrangements can be made for disposing of the dredged material with economy.

July 1, 1894, balance unexpended	$594.20
Amount appropriated by act of August 17, 1894	4,000.00
	4,594.20
June 30, 1895, amount expended during fiscal year	552.50
July 1, 1895, balance unexpended	4,041.70
Amount (estimated) required for completion of existing project	13,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	4,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D 24.)

25. Browns Creek, Sayville, N. Y.—This is a narrow stream extending northward from Great South Bay to the Sayville highway bridge, above which it is wholly a fresh-water creek. The natural depth in the creek was from 1 to 3 feet at low tide, and on a bar at the mouth it was less that 1 foot.

A survey was made by order of Congress in 1889 and a project was adopted for making the creek 100 feet wide and 4 feet deep at mean low water, the entrance channel to be protected by riprap jetties on either side, at a total estimated cost of $46,000.

The total amount appropriated for this work is $21,000.

July 1, 1894, the west jetty had been completed to a length of 492 feet and the east jetty to 438 feet. A channel 100 feet wide and 4 feet deep at mean low water had been dredged 1,893 feet long, extending up the stream. This channel was freely used by oyster boats for refuge, and private canals cut through the adjacent meadows were used for the same purpose.

During the past fiscal year no work was done.

The available funds specifically appropriated for maintenance of the channel will be so applied during the ensuing year.

Future appropriations should be applied to extending the channel as far up the stream as may be necessary.

July 1, 1894, balance unexpended	$200.83
Amount appropriated by act of August 17, 1894	4,000.00
	4,200.83
June 30, 1895, amount expended during fiscal year	2.11
July 1, 1895, balance unexpended	4,198.72
Amount (estimated) required for completion of existing project	25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	4,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D 25.)

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26. Removing sunken vessels or craft obstructing or endangering navigation.—1. The schooner *Clara E. Simpson* was sunk in Long Island Sound, off Eatons Neck light-house, by collision with a steamer on the night of December 4, 1894. She lay in about 15 fathoms depth of water, and an examination showed that no part of the vessel except the masts came within 30 feet of the water surface. The masts were removed during the examination, January 17, 18, 1895.

2. The schooner *Geo. Hotchkiss* was drawn up on the flats in New Haven Harbor, Connecticut, about ten years ago, and abandoned then. Subsequently she was moved into another part of the harbor and outside the harbor lines. She is completely dismantled and by authority of the Secretary of War she will be destroyed without cost to the United States.

3. The bark *Hoppet* was towed into Manhasset Bay, New York, about six years ago, and proving useless was dismantled and abandoned, together with two canal-boat hulks lying alongside her. After duly advertising, a contract for removal of the three hulks was entered into, and the work is now in progress.

The amount expended during the year upon removal of these wrecks was $111.90.

(See Appendix D 26.)

EXAMINATIONS AND SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations and survey of the following localities, required by the act of August 17, 1894, were made by the local engineer, Col. H. M. Robert, Corps of Engineers, and reports thereon submitted:

1. Preliminary examination of harbor of West Haven, and West River from the steam railroad crossing to the main channel of New Haven Harbor, Connecticut.—Colonel Robert submitted report of examination November 8, 1894. He is of opinion, concurred in by this office, that this locality is worthy of improvement by the General Government. No survey is necessary at this time, the results of one made in 1875, with the observations made on this preliminary examination, affording sufficient data for the preparation of plan and estimate for this improvement. The report was transmitted to Congress and printed in House Ex. Doc. No. 27, Fifty-third Congress, third session. (See also Appendix D 27.)

2. Preliminary examination of Black Rock Harbor, Connecticut.—Colonel Robert submitted report of examination October 3, 1894. It is his opinion, concurred in by this office, that this locality is worthy of improvement by the General Government so far as relates to deepening, widening, extending, and protecting the existing channel. No survey is necessary to prepare plan and estimate for improvement. The report was transmitted to Congress and printed in House Ex. Doc. No. 46, Fifty-third Congress, third session. (See also Appendix D 28.)

3. Preliminary examination of Greenwich Harbor, Connecticut.—Colonel Robert submitted report of examination November 26, 1894. He considers the locality worthy of improvement by the General Government, and his opinion is concurred in by this office. It is estimated that $250 will be required to make the necessary survey for the preparation of project and estimate of cost of improvement. The report was transmitted to Congress and printed in House Ex. Doc. No. 25, Fifty-third Congress, third session. (See also Appendix D 29.)

4. Preliminary examination of Byram Harbor, Connecticut.—Colonel Robert submitted report of examination November 26, 1894. He is of

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opinion, concurred in by this office, that the locality is worthy of improvement by the General Government. The survey necessary for preparation of plan and estimate of cost of improvement may be made for $250. The report was transmitted to Congress and printed in House Ex. Doc. No. 23, Fifty-third Congress, third session. (See also Appendix D 30.)

5. Preliminary examination of Byrams Cove Harbor, Massachusetts.—Efforts to locate this harbor have been unsuccessful, and it is presumed the locality intended to be examined is Byram Harbor, Connecticut, for which provision was also made in the act. A report of examination of the latter harbor is submitted herewith as Appendix D 30.

6. Preliminary examination of Port Chester Harbor, New York.—Colonel Robert submitted report of examination October 26, 1894. In his opinion, concurred in by this office, the locality is worthy of further improvement by the United States, with the object of deepening and widening the channel. Sufficient information is already on hand for preparation of plans and estimate of cost of the desired improvement. The report was transmitted to Congress and printed in House Ex. Doc. No. 45, Fifty-third Congress, third session. (See also Appendix D 31.)

7. Preliminary examination of Milton Harbor at Milton Point, New York.—Colonel Robert submitted report of examination November 26, 1894. It is his opinion, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 28, Fifty-third Congress, third session. (See also Appendix D 32.)

8. Preliminary examination of Echo Bay and New Rochelle Harbor, New York.—Colonel Robert submitted report of examination November 24, 1894. He considers the locality not worthy of improvement by the General Government, and this opinion is concurred in by this office. The report was transmitted to Congress and printed in House Ex. Doc. No. 38, Fifty-third Congress, third session. (See also Appendix D 33.)

9. Preliminary examination of harbor of Greenport, N. Y.—Colonel Robert submitted report of examination October 26, 1894. He is of opinion, concurred in by this office, that the locality is worthy of further improvement by the United States with the object in view of deepening the anchorage ground in Sterling Basin and widening and deepening its approaches. The surveys already made afford essential information for preparation of plans and estimates of cost of improvement. The report was transmitted to Congress and printed in House Ex. Doc. No. 44, Fifty-third Congress, third session. (See also Appendix D 34.)

10. Preliminary examination of Cold Spring Harbor, New York.—Colonel Robert submitted report of examination November 28, 1894. He does not consider the locality worthy of improvement by the General Government, and this opinion is concurred in by this office. The report was transmitted to Congress and printed in House Ex. Doc. No. 43, Fifty-third Congress, third session. (See also Appendix D 35.)

11. Preliminary examination of Hempstead Harbor, New York.—Colonel Robert submitted report of examination December 31, 1894. He reports that work for improvement of this locality is being carried on under appropriations made by Congress for improving Glen Cove Harbor, and that he does not consider the locality as worthy of improvement by the General Government, except to the extent contemplated by the present project. His views are concurred in by this office. The report was transmitted to Congress and printed in House Ex. Doc. No. 163, Fifty-third Congress, third session. (See also Appendix D 36.)

12. Preliminary examination of Woodsburg Channel, Hempstead Bay, New York.—Colonel Robert submitted report of examination November

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24, 1894. He does not consider the locality worthy of improvement by the General Government, and his views are concurred in by this office. The report was transmitted to Congress and printed in House Ex. Doc. No. 68, Fifty-third Congress, third session. (See also Appendix D 37.)

13. Survey of Cos Cob Harbor and Mianus River, Connecticut.—The river and harbor act of August 17, 1894, in the item making an appropriation for improving harbor at Cos Cob and Mianus River, Connecticut, provides for a survey of the lower part of the harbor with a view of making a turning basin therein. Colonel Robert submitted report of the results of the survey thus provided for June 19, 1895. He presents project for widening, by dredging, the channel in the lower part of the harbor to serve the purposes of a turning or anchorage basin, and estimates the cost of the work at $18,000. (See Appendix D 38.)

Colonel Robert was also charged with the duty of making surveys of—

1. Westport Harbor, Connecticut.

2. Norwalk Harbor, Connecticut.

The reports of the results of these surveys will be duly submitted when received.

IMPROVEMENT OF HUDSON RIVER AND NEW YORK HARBOR AND OF RIVERS AND HARBORS IN THEIR VICINITY, NEW YORK AND NEW JERSEY, OF RIVERS AND HARBORS IN SOUTHWESTERN PART OF LONG ISLAND AND NEAR STATEN ISLAND, NEW YORK, AND IN NORTHEASTERN NEW JERSEY.

This district was in the charge of Lieut. Col. G. L. Gillespie, Corps of Engineers, having under his immediate orders Lieut. Robert McGregor, Corps of Engineers; and in the temporary charge of Lieutenant McGregor from July 5 to October 23, 1894.

1. Hudson River, New York.—The improvement of this river was restricted, prior to 1892, by the wording of the appropriation acts to that part of it lying between Troy, at the head of navigation, 6 miles above Albany, and New Baltimore, about 14 miles below Albany.

Before the improvement was begun the navigable depth in the channel between New Baltimore and Albany was 7½ feet at mean low water; between Albany and Troy, 4 feet.

The mean range of tides at State Dam at Troy is 0.80 foot; at Albany, 2.32 feet; and at New Baltimore, 3.42 feet.

The plan of improvement adopted in 1867 proposed making the navigable depth between New Baltimore and Albany 11 feet, and between Albany and Troy 9 feet. This was to be accomplished by the construction of longitudinal dikes to direct the currents and by dredging.

The estimated cost of making this improvement, prepared in 1882, subject to be increased, was $1,078,304. In 1889 the estimated cost was $1,424,435.

The river and harbor act of July 13, 1892, sanctioned the new project submitted in 1891, which provided for maintaining old improvements and constructing new regulating works along 8 additional miles of the river below New Baltimore, and also for deepening the entire reach of the river under improvement so as to afford a channel 400 feet wide and 12 feet deep at mean low water from Coxsackie to the foot of Broadway, Troy, N. Y., and thence 300 feet wide and 12 feet deep to the State Dam. The estimated cost of the project is $2,500,000.

The amount expended to June 30, 1894, inclusive of outstanding liabilities, was $1,576,620.83, of which sum a large part has, however, from the necessities of the case, been applied partly to the repair of

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decaying dikes and partly to dredging. At that date the dikes provided for in the project of improvement, so far as built, had resulted in securing a channel depth of 11 feet from New Baltimore to Albany and of 8 feet from Albany to Troy.

Under the new project contracts were entered into for the removal of all the rock and sand covering rock in place and for all the dike work and dredging required for the improvement.

The amount expended during the fiscal year ending June 30, 1895, inclusive of outstanding liabilities, was $582,428.85, and was applied, under contract, to the construction of 8,556 feet of new dikes; to the repairs of 10,020 feet of old dikes; to dredging 1,125,954 cubic yards of material from the channel at Coxsackie Shoal, Stone House Bar, New Baltimore Bar, Mulls Cross Over, Castleton Bar, Cedar Hill Bar, Winnies Bar, Stone Light Shoal, Cuylers Bar, Bath Shoal, and at Breaker Island; to the removal of 32,700 tons of rock and 6,586 tons of sand covering rock at Mulls Cross Over, Breaker Island, Austins East Rock, and rock in front of Watervliet Arsenal; to the paving of 2,151 square yards of dike, and to the removal of one wreck from navigable channel under improvement.

July 1, 1894, balance unexpended		$464,026.35
Amount appropriated by sundry civil act approved August 18, 1894		145,000.00
Amount appropriated by sundry civil act approved March 2, 1895		500,000.00
		1,109,026.35
June 30, 1895, amount expended during fiscal year		470,259.20
July 1, 1895, balance unexpended		638,767.15
July 1, 1895, outstanding liabilities	$112,169.65	
July 1, 1895, amount covered by uncompleted contracts	509,065.09	
		621,234.74
July 1, 1895, balance available		17,532.41
Amount (estimated) required for completion of existing project		1,115,406.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		500,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix E 1.)

2. Harbor at Saugerties, N. Y.—This harbor is formed by the mouth of Esopus Creek, which empties into the Hudson River, on the west bank, about 100 miles above New York City.

The bar at the entrance at the time of the original examination, made in November, 1883, with the view of preparing estimates for improvement, had a navigable depth of 3 feet only at mean low water, and the distance between the 6-foot curves across it was 1,100 feet. The harbor could therefore be entered only at high water even by the smallest class of vessels. The range of tides is 4 feet approximately.

The plan of improvement, which was adopted in 1887, provided for securing a depth of 8 feet mean low water from the entrance to the head of navigation, 1¾ miles, by the construction of two parallel dikes, each 2,300 feet long, 260 feet apart on the inside and 280 feet apart on the outside, and by dredging, if found necessary, 30,000 cubic yards of material from the channel between the dikes.

The estimated cost of the improvement was $52,000.

The amount expended upon the project up to the close of the fiscal year ending June 30, 1894, was $46,809.25. At that date both dikes had been completed; the north dike had a length of 2,058 feet and the south dike a length of 2,363 feet, and the waterway between them was

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260 feet wide, and the navigable channel had been deepened by dredging for a width of 150 feet between 9-foot curves. By dredging and blasting rock at Barclays Point the channel was widened to the southward 68 feet and deepened to 9 feet at mean low water, affording a much-desired relief to the navigation of the inner harbor.

The amount expended during the fiscal year ending June 30, 1895, was $125.33, and was applied in making an examination of the channel and dikes, and in preparing an agreement for repairs to 200 feet of the north dike.

The existing channel from the entrance to head of navigation is 200 feet wide and 8 feet deep at mean low water.

July 1, 1894, balance unexpended	$190.75
Amount appropriated by act of August 17, 1894	5,000.00
	5,190.75
June 30, 1895, amount expended during fiscal year	125.33
July 1, 1895, balance unexpended	5,065.42
July 1, 1895, amount covered by uncompleted contracts	1,134.00
July 1, 1895, balance available	3,931.42
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	2,500.00

(See Appendix E 2.)

3. Harbor at Rondout, N. Y.—This harbor is formed by the mouth of Rondout Creek, which empties into the Hudson River on its west side about 90 miles above the city of New York, and is the eastern terminus of the Delaware and Hudson Canal. The creek is a tidal stream for 3 miles above its mouth, and prior to 1871 all improvements had been made by private parties. The range of tides is 4 feet approximately.

The Government made a survey of the harbor in 1869, and the available depth of water then in the channel was 7 feet at mean low water. The project of improvement, based on this survey, was for the formation and maintenance of a channel 100 feet wide and 14 feet deep, mean low water, at the mouth of the creek, to be obtained by means of dikes and dredging. The parallel channel dikes, 350 feet apart at the entrance, were to be built outward into the Hudson River, and a branch dike upstream, starting at outer end of north pier, to protect the north dike against destruction by ice.

The estimated cost of the project was $172,500.

The project was completed in 1880, at an actual cost of $90,000 only. At that time the length of the north dike was 2,200 feet and that of the south dike 2,800 feet, and there was a channel between them 50 feet wide and 13½ deep, mean low water, and 100 feet wide and 12 feet deep, mean low water.

The appropriations which have been made since 1880 have been applied exclusively to the repair of the dikes.

The amount expended upon the project and upon repairs up to the close of the fiscal year ending June 30, 1894, was $111,500, at which date the navigable channel was 100 feet wide and from 12½ feet to 13½ feet deep, mean low water. The dikes were built originally of timber and stone to the height of mean high water, but the timber has since become so damaged by age and by the ice that the stone filling in many places has fallen out from between the rows of piles, and the height of the dikes has been correspondingly lowered.

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The amount expended during the fiscal year ending June 30, 1895, was $41.34, and was applied in printing specifications and preparing contract for extending south dike 200 feet. Active work under this contract will begin July 1, 1895.

The channel is in only fair condition, and annual repairs to the dikes will continue to be needed.

Amount appropriated by act of August 17, 1894	$5,000.00
June 30, 1895, amount expended during fiscal year	41.34
July 1, 1895, balance unexpended	4,958.66
July 1, 1895, amount covered by uncompleted contracts	2,212.20
July 1, 1895, balance available	2,746.46
Amount (estimated) required for completion of existing project	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	2,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix E 3.)

4. Wappinger Creek, New York.—Wappinger Creek is a small stream which empties into the Hudson River on the left bank one-half mile below the village of New Hamburg, N. Y. The navigable portion, extending from the mouth to Wappinger Falls, is 2 miles long, approximately, and before improvement afforded navigation to small boats drawing not exceeding 6 feet in a waterway which had a width varying from 25 feet to 75 feet. The range of tides at entrance is 4 feet, approximately.

The project for its improvement, contained in the report upon the survey, November 11, 1889, to comply with the river and harbor act of August 11, 1888, contemplates a channel 80 feet wide and 8 feet deep from the mouth to the falls. The estimated cost of the improvement was $13,000. The amount appropriated by the river and harbor act of September 19, 1890, was $13,000, all of which has been expended.

At the close of the fiscal year ending June 30, 1894, the channel was 80 feet wide and 8 feet deep, mean low water, from the mouth to the falls.

The approved project for the improvement was completed April 30, 1892.

(See Appendix E 4.)

5. Harlem River, New York.—The Harlem River and Spuyten Duyvil Creek are both included in this improvement.

Originally there was no navigable waterway between the two streams, as the bed of the connecting reach at Kingsbridge was a long reef of solid rock, bare at low water. The head of navigation at low tide in the Harlem River was practically at High Bridge, 5 miles from its junction with East River at Hell Gate, for vessels of 7 feet draft, and at high tide in Spuyten Duyvil Creek, near Kingsbridge, 1¾ miles from the Hudson, for vessels of 8 feet draft.

The object of the improvement is to form a navigable channel between the East and Hudson rivers.

The project for the improvement, as originally adopted in 1875, was for a channel 350 feet wide and 15 feet deep at mean low water. In 1879 the project was so far modified as to increase the width of the channel in the Harlem River and Spuyten Duyvil Creek to 400 feet, retaining the original width of 350 feet through Dyckman Meadow, but increasing the depth there to 18 feet mean low water. This project was revised in 1886 by narrowing the channel immediately north of High Bridge, where it skirts the Ogden estate on the east bank, to a least width of 375 feet.

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The estimated cost of the work was $2,700,000.

The amount expended upon the improvement up to the close of the fiscal year ending June 30, 1894, inclusive of outstanding liabilities, was $845,715.31. At that date the excavation of the section of canal prism lying between the two dams had been completed, with the exception of about 600 cubic yards of rock in the northeast corner of the cut, covering an area of 50 by 60 feet, with a least depth of 13 feet over it at mean low water; the remains of the dam at the west end of the cut were removed to a depth of 18 feet at low water, and the section of meadow lying directly west of the west dam was excavated to a depth of from 12 feet to 15 feet below low water to a connection with the channel dredged under former contracts through the bed of Spuyten Duyvil Creek and intervening meadows to the Hudson River, thus establishing a continuous waterway from the Hudson River to the new drawbridge then under construction across the canal at Broadway, Kingsbridge. From the rock cut westward the improved channel was from 140 to 150 feet wide and 9 feet deep at mean low water, while the rock cut itself had a depth of 18 feet at low water and width of about 350 feet.

In the Harlem River a channel 9 feet deep, mean low water, had been dredged from a point 600 yards north of Morris Dock, where it connects with the natural channel, to within 120 feet of the temporary bridge located directly east of the east dam, and built by the city of New York for use during the construction of the above-mentioned permanent bridge at this point. There was an opening about 120 feet wide in the east dam, through which the tide flowed freely, but navigable communication between the Hudson and Harlem rivers was shut off by the temporary bridge, which is not provided with a drawspan.

The channel at the crossover directly south of Morris Dock had been deepened to a depth of 10 feet at mean low water for a width of 150 feet by the removal of bowlders and other hard material, and the waterway through the east, west, and center bays of High Bridge had been cleared of bowlders and other obstructions to a depth of 10 feet at low water, so that vessels drawing 10 feet could ascend the river at low water as far as Morris Dock, from which point, as already stated, 9 feet could be carried in a channel 140 to 160 feet wide to within 120 feet of the temporary bridge at Broadway.

The amount expended during the fiscal year ending June 30, 1895, inclusive of outstanding liabilities, was $119,375.69. At that date the rock cut through Dyckman Meadow was practically completed to the projected width of 350 feet and depth of 18 feet at mean low water. From the rock cut westward to the Hudson River, a channel 140 to 160 feet wide and 12 feet deep, mean low water, had been excavated through the valley of Spuyten Duyvil Creek, so that vessels drawing 12 feet could ascend the improved channel at low water from the Hudson River to the new bridge at Broadway. From this point eastward the channel in the Harlem River had been dredged to a width of 150 to 180 feet and depth of 9 feet, mean low water, to a point 600 yards north of Morris Dock. From there on to Macomb Dam Bridge, at One hundred and fifty-fifth street, the available channel was 160 feet wide and 10 feet deep at mean low water, and thence 15 feet and over could be carried to Wards Island, East River. By the removal of Candle Factory Reef and the shoal on the opposite side of the river south of Randall Island Dock, the available channel width on this section of the river was increased from an original width of 100 feet to a present width of 300 feet, thus greatly relieving the crowded navigation of this reach of the stream. The draft of vessels passing through the

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improved channel from the Hudson River to the East River at low water is at present limited to 9 feet, but by the completion of the work already under contract a 12-foot depth will be secured from river to river in a channel nowhere less than 150 feet in width.

July 1, 1894, balance unexpended		$89,242.64
Amount appropriated by act of August 17, 1894		125,000.00
		214,242.64
June 30, 1895, amount expended during fiscal year		89,409.56
July 1, 1895, balance unexpended		124,833.08
July 1, 1895, outstanding liabilities	$29,966.13	
July 1, 1895, amount covered by uncompleted contracts	56,439.39	
		86,405.52
July 1, 1895, balance available		38,427.56

Amount (estimated) required for completion of existing project	1,680,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	125,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix E 5.)

6. East River and Hell Gate, New York.—Originally the channel of East River contained many dangerous rocky obstructions to navigation lying both above and below mean low water. Especially was this the case at Hell Gate, where the bounding beaches had irregular and shoal rocky foreshores and the inclosed waterway had a few detached rocky isles with crests rising several feet above high-water mark.

At Hell Gate the channel turns at right angles around Hallets Point, Astoria, and the current runs with a velocity varying at different stages of the tide from 3 to 10 miles an hour over or around Way Reef, Pot Rock, Shell Drake, Frying Pan, Hallets Point, Negro Point, Holmes Rock, Hog Back, Heel Tap, Flood Rock, Hen and Chickens, Gridiron, Mill Rocks, The Negro Heads, Rhinelander Reef, and Bread and Cheese.

Hallets Point projected from the shore at Astoria under water 325 feet to the 26-foot contour, mean low water, and embraced an area of 3 acres.

The detached rocks in the inclosed waterway had varying depths over them. The Middle Reef, with an area of about 9 acres, lay in the middle of the channels at Hell Gate.

It had a small backbone projecting above high water called Flood Rock, upon which vessels were frequently stranded at ebb tide, when the currents swept directly over the rock. To the northward, near the mouth of the Harlem River, lay the two Mill Rocks, both of which were usually visible at high water. To the eastward, Frying Pan had only 11 feet, mean low water; Heel Tap, 12 feet; Pot Rock, 20 feet, and North Brother Island Reef, 16 feet.

The project of improvement, adopted in 1867, provided for the removal to the depth of 26 feet, mean low water, of the rocks and reefs that lay directly in the channel at Hell Gate and for the construction of sea walls and dikes upon others that lay near the edge of the channel. The estimated cost of the project, revised in 1870, was $4,689,820.

Besides the obstructions before enumerated submerged rocks were known to exist at other points in the channel, such as Diamond Reef, 15½ feet, mean low water, off the Battery; Coenties Reef, 14.3 feet, mean low water, off Coenties Slip; Shell Reef, 9 feet, mean low water, between Eighth and Tenth streets; Ferry Reef, 7 feet, mean low water, and Charlotte Rock, 14½ feet, mean low water, opposite Thirty-fourth street; the Middle Ground, 11½ feet, mean low water, off Sunken

Meadow, at the entrance to Little Hell Gate, and Midchannel Reef, 16½ feet, mean low water, at Baretto Point opposite Rikers Island.

The project was enlarged in 1874 and the total cost estimated at $5,139,120 (Annual Report Chief of Engineers, 1874, Part II, p. 164). Besides the improvements already projected at Hell Gate the new project provided for the construction of a riprap dike to connect the Mill Rocks, sea walls upon Hog Back and Holmes Rock, and the removal to a depth of 26 feet, mean low water, of Diamond Reef, Coenties Reef, and the small rocks known as Scaly Rock, Blackwells Rock, and the rock off Woolsey's bath house.

The project was enlarged in 1884 to provide for the removal of Pilgrim Rock, opposite Nineteenth street, to 24 feet, mean low water; in 1889, for the removal of reef off Diamond Reef to 26 feet, mean low water, and Ferry Reef, and Charlotte Rock, opposite Thirty-fourth street, to 26 feet, mean low water; in 1890, for the removal of Shell Reef and reef off Sunken Meadows to 18 feet, mean low water, and in 1892, for the removal of Baretto Reef to 24 feet, mean low water.

The amount expended up to the close of the fiscal year ending June 30, 1894, was $4,238,953.49. At that date Hallets Point, covering 3 acres, Way Reef, Shell Drake, Diamond Reef, North Brother Island Reef, Coenties Reef, reef off Diamond Reef, Baretto Reef, and Scaly Rock had been removed to the depth contemplated in the project. Pilgrim Rock and Ferry Reef, off Thirty-fourth street, had been reduced to a least depth of 24 feet; Heel Tap had been broken to 26 feet and dredged to 20.5 feet, and the least depths on Frying Pan and Pot Rock were 18 feet and 22.8 feet at mean low water, respectively. Flood Rock and connecting reefs, covering 9 acres, had been broken to 30 feet and 204,015 tons of débris had been removed. The least depth over Flood Rock, Hen and Chickens, and Gridiron was 20 feet at mean low water, and that in the channel between Flood Rock and the Mill Rocks was 18 feet, mean low water. Shell Reef, off Ninth street, had been reduced to 18 feet, mean low water, except at a few points. The reef off Sunken Meadow, which originally had only 11 feet over it, had been lowered to 14 feet, mean low water, over the main reef, and to 18 feet, mean low water, on the southern half. A sea wall had been built by the Government to connect Great and Little Mill Rocks, and another by the city authorities on Bread and Cheese. These results have been of the greatest value to navigation.

The amount expended during the fiscal year ending June 30, 1895, inclusive of outstanding liabilities, was $48,411.46, and was applied in removing by hired labor 681 tons of broken stone by the use of U. S. steam drilling scow *General Newton* from reef off Sunken Meadow and to repair of U. S. engineer dredge *Hell Gate.*

July 1, 1894, balance unexpended	$11,407.58
Amount appropriated by act of August 17, 1894	75,000.00
	86,407.58
June 30, 1895, amount expended during fiscal year	28,719.80
July 1, 1895, balance unexpended	57,687.78
July 1, 1895, outstanding liabilities	19,691.66
July 1, 1895, balance available	37,996.12
Amount (estimated) required for completion of existing project	813,840.67
Amount that can be profitably expended in fiscal year ending June 30, 1897	75,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix E 6.)

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7. Newtown Creek, New York.—This is a tidal stream, about 4 miles long, running through the eastern part of Brooklyn and emptying into the East River opposite Thirty-fourth street, New York City.

It had formerly a depth of 12½ feet mean low water at the mouth, gradually decreasing to 4 feet at the head.

The original project for improvement, adopted in 1880, but modified in 1883, provided for a channel 200 feet wide and 21 to 22 feet deep, mean low water, extending from the mouth up to Vernon avenue bridge and from that point up to the head of navigation on both branches, a channel decreasing from 175 feet to 100 feet in width and from 18 feet to 10 feet in depth, at an estimated cost of $255,569.

The amount expended up to the close of the fiscal year ending June 30, 1894, inclusive of outstanding liabilities, was $177,500. At that date the channel from the entrance to Vernon avenue bridge was 175 feet wide and 18 feet deep, mean low water; from Vernon avenue bridge to Central Oil Works, 80 feet wide and 16 feet deep; from Central Oil Works to Queens County Oil Works, 100 feet wide and 14 feet deep; from Queens County Oil Works to Nichol's Chemical Works, 75 feet wide and 10 feet deep; from Nichol's Chemical Works to Maspeth avenue, 50 feet wide and 10 feet deep; from Maspeth avenue to Metropolitan avenue, East Branch, 100 feet wide and 9 feet deep, and on the West Branch 50 feet wide and 10 feet deep. In the English Kills Branch the channel was 100 feet wide and 8 feet deep, mean low water, from Nichol's Chemical Works to a point 700 feet to the eastward.

The amount expended during the fiscal year ending June 30, 1895, was $20,000, and was applied in dredging 72,394 cubic yards from various reaches of the creek. At the close of the year the 18-foot channel from the entrance to Vernon avenue bridge was 175 feet wide at the entrance and 150 feet wide near the bridge, with a 21-foot channel 40 feet wide through the center. The channel from Vernon avenue bridge to Central Oil Works was 80 feet wide and 16 feet deep, mean low water, with an 18-foot channel 40 feet wide through the center; from Central Oil Works to Queens County Oil Works, 100 feet wide and 14 feet deep; from Queens County Oil Works to Nichol's Chemical Works, 100 feet wide and 12 feet deep; from Nichol's Chemical Works to Maspeth avenue, 75 feet wide and 10 feet deep; from Maspeth avenue to Metropolitan avenue, on the East Branch, 100 feet wide and 10 feet deep, and on the West Branch, 50 feet wide and 10 feet deep. In the English Kills Branch the channel is 100 feet wide and 8 feet deep from Nichol's Chemical Works to a point 700 feet to the eastward.

The cause of the habitual shoalings immediately following dredging is the absence of bulkheads to confine the banks.

The existing channel is not adequate, in width or depth, to the demands of commerce, and the new improvement should be executed by methods which will carry it progressively from the mouth to the head of navigation.

Amount appropriated by act of August 17, 1894	$20,000.00
June 30, 1895, amount expended during fiscal year	20,000.00
Amount (estimated) required for completion of existing project	58,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	20,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix E 7.)

8. Buttermilk Channel, New York Harbor.—Buttermilk Channel lies between the city of Brooklyn, N. Y., and Governors Island, New York Harbor, and was formerly obstructed by three shoals:

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(1) A shoal lying above and northeast of Governors Island, projecting into Buttermilk Channel and extending over to the main channel on the other side, which originally had a least depth over it of 9½ feet at mean low water.

(2) A shoal putting out from Red Hook Point, on the Brooklyn side, and extending up the eastern side of the channel to the entrance to the Atlantic Basin, with a least depth over it of about 6 feet at mean low water.

(3) A shoal putting out from the southern side of Governors Island and extending toward Red Hook Point Shoal, which is partly dry at mean low water.

The original project of improvement, adopted in 1880, provided for the removal to a depth of 26 feet, mean low water, of such parts of the first-mentioned shoal as came within 850 feet of the Brooklyn wharves. It embraced the crest of the shoal, and gave elsewhere to the north and west a depth of not less than 15 feet, mean low water.

The estimated cost of the improvement was $210,000. In view of the increasing importance of the wharves on the Brooklyn shores and the difficulty experienced by deep-draft vessels in getting up to them by reason of this shoal, the project of improvement was modified in 1885 so as to provide for the removal of the entire shoal to a depth of 26 feet mean low water, at an estimated additional cost of $150,000, making the total estimated cost of the project $360,000.

The river and harbor act of September 19, 1890, made provision for the survey of Red Hook Shoal, lying at the southern entrance to the Buttermilk Channel, and the estimated cost of the removal of this shoal to a depth of 26 feet at mean low water was $529,000.

The amount expended to the close of the fiscal year ending June 30, 1894, inclusive of outstanding liabilities, was $445,413.07, and was applied mainly in dredging the shoal lying above Governors Island. This shoal had been entirely removed to a depth of 26 feet mean low water. Red Hook Shoal had been dredged to a depth of 26 feet mean low water for a width of 440 feet from the northern edge of the shoal marked by red buoy No. 2 southward toward the Brooklyn shore.

The amount expended during the fiscal year ending June 30, 1895, inclusive of outstanding liabilities, was $13,968.34, and was applied in dredging 52,602 cubic yards of material from Red Hook Shoal, giving an additional width of 80 feet.

July 1, 1894, balance unexpended		$936.93
Amount appropriated by act of August 17, 1894		50,000.00
		50,936.93
June 30, 1895, amount expended during fiscal year		4,171.81
July 1, 1895, balance unexpended		46,765.12
July 1, 1895, outstanding liabilities	$9,796.53	
July 1, 1895, amount covered by uncompleted contracts	29,349.50	
		39,146.03
July 1, 1895, balance available		7,619.09
Amount (estimated) required for completion of existing project		354,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		50,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix E 8.)

9. Gowanus Bay, New York.—Red Hook, Gowanus Creek, and Bay Ridge Channels.—Gowanus Bay is a part of New York Harbor, lying at the mouth of Gowanus Creek, in the southwestern part of the city of Brooklyn.

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The depth of water in the channel of Gowanus Creek and Bay was originally only from 7 to 12 feet at mean low water, which was wholly insufficient for the passage of vessels employed in the commerce of the district.

The plan of improvement adopted in 1881 provided for a depth of 18 feet to the channels in the bay leading up to the mouth of the creek on both the north and south sides, and for carrying the improvement with the same depth up the creek to Hamilton avenue bridge, a distance of 1 mile.

The channel widths were to be 200 feet, except for the last few hundred feet up to the bridge, in which distance the width would gradually decrease.

The estimated cost of this improvement was $192,564.90.

The project for 1881 was modified in 1888 by increasing the depth to 21 feet and the width to 400 feet, while to facilitate the handling of vessels in the contracted space near the mouth of Gowanus Creek more room was provided for by cutting away the angle on the south side, at an estimated total cost of $600,000.

The river and harbor act of August 17, 1894, enlarged the modified project of 1888 by providing a width of 800 feet and a depth of 26 feet, mean low water, for Bay Ridge Channel, and a width of 400 feet and depth of 26 feet, mean low water, for Red Hook Channel. The total estimated cost of this enlarged project, exclusive of the appropriation contained in the river and harbor act of August 17, 1894, is $483,300.

The amount expended on the Gowanus Bay channels up to June 30, 1894, inclusive of outstanding liabilities, was $132,973.98. At that date the Red Hook Channel, from the entrance to Erie Basin, to a point 2,000 feet south, was 400 feet wide and 21 feet deep, mean low water; thence to Henry street 325 feet wide and 21 feet deep. The Gowanus Creek Channel, from Henry street to the foot of Percival street, was 215 feet wide and 21 feet deep.

The improvement of Bay Ridge Channel, extending from Twenty-eighth street south and west to Sixtieth street, south shore, which under the project of 1881 was suspended in 1884, was resumed in 1891, under a specific appropriation of $100,000, contained in the river and harbor act of September 19, 1890, which provided for a channel 400 feet wide and 21 feet deep. At the close of the last fiscal year this channel was 375 feet wide and 21 feet deep, mean low water, from Twenty-eighth street south to Forty-second street, and thence 300 feet wide and 21 feet deep to Sixtieth street, Bay Ridge.

The amount expended during the fiscal year ending June 30, 1895, on the Gowanus Bay channels, inclusive of outstanding liabilities, was $138,868.95, and was applied in removing 757,006 cubic yards of material under contract. At that date, in the Red Hook Channel, the 26-foot channel was 80 feet wide from the entrance to Erie Basin to Henry street, while the 21-foot channel was 400 feet wide throughout. The Gowanus Creek Channel was 250 feet wide and 21 feet deep from Henry street to Percival street.

In the Bay Ridge Channel the 26-foot channel was 80 feet wide from Twenty-eighth street to Thirty-sixth street, and thence 40 feet wide to Sixtieth street, while the 21-foot channel was 400 feet wide throughout.

The beds of both channels have been lowered from 5 to 20 feet, and as the material removed has been sand, the banks, having no confining bulkheads, have correspondingly increased their slopes, the unstable material sliding into the channels and reducing their depth.

The channels also suffer from deposits carried down from Gowanus Canal, and from deposits brought in from outlying shoals by the waves.

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These sources of degradation will be appreciably exhausted only when permanent bulkheads are built along both shores to hold the soft and unstable banks.

July 1, 1894, balance unexpended		$87,903.57
Amount appropriated by act of August 17, 1894		150,000.00
		237,903.57
June 30, 1895, amount expended during fiscal year		121,018.82
July 1, 1895, balance unexpended		116,884.75
July 1, 1895, outstanding liabilities	$17,850.13	
July 1, 1895, amount covered by uncompleted contracts	83,701.65	
		101,551.78
July 1, 1895, balance available		15,332.97

Amount (estimated) required for completion of existing project	483,300.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	125,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix E 9.)

10. New York Harbor, New York.—Before the improvement of the main entrance into New York Harbor was undertaken by the United States the least depth in mid-channel on the bar was 23.7 feet at mean low water, and the same was the limiting depth across three other shoals between the bar and deep water in the harbor.

A large proportion of the vast commerce of the port, which is carried on in vessels of great draft, could only cross these shoals at or near high water.

The project for the improvement of Gedney Channel was approved by the Secretary of War in December, 1884, and its extension to cover the whole of the main entrance to the harbor received his approval December 27, 1886. It provides for dredging a channel 1,000 feet wide and 30 feet deep at mean low water from deep water below the Narrows through the Main Ship Channel and Gedney Channel to deep water outside the bar; maintaining this channel, should it be necessary, either by periodical dredging or by contracting the entrance by the construction of a dike running across the shoals from the Coney Island side, with suitable protection for the head of Sandy Hook to prevent its being scoured away by the increased current.

The estimated cost of obtaining the dredged channel was $1,490,000 for dredging 4,300,000 cubic yards, and the entire cost of the improvement, should the contraction works prove to be necessary, was estimated at between $5,000,000 and $6,000,000.

Under this project an extended survey of the lower bay was made, on which the method of improvement was based.

The total amount expended to June 30, 1894, inclusive of outstanding liabilities, was $1,642,356.56. At that time the approved project for this work by dredging had been completed, and a depth of 30 feet, mean low water, for a channel width of 1,000 feet, had been secured from deep water below the Narrows to deep water beyond the bar.

The riprap sea wall authorized by the Chief of Engineers February 20, 1890, for the protection of the north shore of Sandy Hook, was built from Jetty No. 1 westward to a point 119 feet westward of Jetty No. 11, a total distance of 2,575 feet.

Baxter Ledge, a narrow ledge of rock lying in the entrance to Kill van Kull from Upper New York Bay, northeast from St. George, Staten Island, and having over it originally a least depth of 18 feet, mean low water, had been removed to a depth of 25.5 feet, mean low water.

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The amount expended during the fiscal year ending June 30, 1895, inclusive of outstanding liabilities, was $34,888.99, and was applied in operating the U. S. steamer *Gedney* by hired labor, in removing 126,486 cubic yards of material from the Main Ship Channel.

July 1, 1894, balance unexpended	$20,963.38
Amount appropriated by act of August 17, 1894	75,000.00
Received from other sources	13,700.00
	109,663.38
June 30, 1895, amount expended during fiscal year	32,994.89
July 1, 1895, balance unexpended	76,668.49
July 1, 1895, outstanding liabilities	1,894.10
July 1, 1895, balance available	74,774.39
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	75,000.00

(See Appendix E 10.)

11. Jamaica Bay, New York.—Jamaica Bay is a tidal bay, situated on the south side of Long Island, near the western end, whose waters flow into the Atlantic Ocean through Rockaway Inlet.

Inside the entrance there is a deep-water basin, from which one navigable channel leads to the northward in the direction of Canarsie, and another, called Beach Channel, to the eastward, behind Rockaway Beach, in the direction of Far Rockaway. From the eastern terminus of one of the branches of the latter channel, which passes through Conch Hole, an artificial cut into Far Rockaway Bay was made several years ago by citizens to enable small boats to pass eastward through that bay into Hempstead Bay and beyond.

The project for this improvement, contained in the report upon the survey October 29, 1891, to comply with the river and harbor act of September 19, 1890, and sanctioned by river and harbor act of July 13, 1892, contemplated a channel 60 feet wide and 5 feet deep, mean low water, from entrance to Bass Channel to foot of Bayswater avenue, Far Rockaway.

The estimated cost of the project was $9,460. The full amount of this estimate was appropriated by the river and harbor act approved July 13, 1892.

The amount expended up to the close of the fiscal year ending June 30, 1894, inclusive of outstanding liabilities, was $9,460. At that date the channel had been dredged to the full projected width of 60 feet and depth of 5 feet, mean low water, to within 400 feet of the bulkhead at the foot of Bayswater avenue.

(See Appendix E 11.)

12. Raritan Bay, New Jersey.—Raritan Bay forms the western part of the large triangular bay inclosed between Sandy Hook, the New Jersey shore, and Staten Island.

The channel undergoing improvement lies to the southeast of Seguine Point on the south shore of Staten Island. At the time of the original survey, August, 1880, the least depth on the shoal lying between the 21-foot curve at Seguine Point and the 21-foot curve at the head of the bay was 14½ feet, mean low water. The project of improvement, based upon the survey, provided for a channel across the shoal 300 feet wide and 21 feet deep, mean low water, at an estimated cost of $126,500.

The project was enlarged in 1885, providing for a channel of equal width and depth over the shoals in the vicinity of Wards Point, Staten

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Island, where the original depth was 18 feet, mean low water, giving a navigable channel 21 feet deep, mean low water, up to Perth Amboy; and further providing for a channel 300 feet wide and 15 feet deep, mean low water, from Great Beds Light to South Amboy, where the original depth was 12½ feet, mean low water, at an estimated total cost of $240,500 for the two works from the beginning, which estimate was again increased in 1888 to $246,500, to provide for the removal of deposits which had taken place in the interval of three years.

The channel from deep water at the head of Raritan Bay, past Seguine Point to Perth Amboy, exceeds 5 miles in length, is crooked, and is subject to constant shoalings. As the amount appropriated any one year for the execution of the project has been much less than the estimated cost of the improvement, and as the channel excavated under each appropriation has been impaired by shoaling in a greater or less degree before work could be resumed under the succeeding appropriations, the original estimates for this improvement have little value and can not be used for determining the amount required for completing the project at this date. The cost of completing the project, if all the required money could be made available at one time, was estimated in 1891 at $175,375.

The amount expended upon the modified project of 1885, up to the close of the fiscal year ending June 30, 1894, inclusive of outstanding liabilities, was $260,952.82. At the close of the contract, June 15, 1888, the channel was 300 feet wide and 21 feet deep, mean low water, from Perth Amboy to the bend at Great Beds Light, and 300 feet wide and 20 feet deep, mean low water, across the crest of the shoal in the channel leading from the bend toward Sequine Point. At the close of the year the channel eastward of Seguine Point was 250 feet wide and 18 feet deep, mean low water, and the channel from Great Beds Light to South Amboy was 300 feet wide and 14 feet deep, mean low water.

The amount expended during the fiscal year ending June 30, 1895, inclusive of outstanding liabilities, was $39,040.93, and was applied in dredging 123,944 cubic yards of material from Seguine Point Channel and 95,762 cubic yards of material from South Amboy Channel. The channel leading eastward from Seguine Point is 250 feet wide and 18 feet deep, mean low water, with a central depth of 41 feet for a width of 100 feet; and the channel from Great Beds Light to South Amboy is 300 feet wide and 15 feet deep, mean low water.

July 1, 1894, balance unexpended	$1,547.18
Amount appropriated by act of August 17, 1894	40,000.00
	41,547.18
June 30, 1895, amount expended during fiscal year	29,786.39
July 1, 1895, balance unexpended	11,760.79
July 1, 1895, outstanding liabilities	9,254.54
July 1, 1895, balance available	2,506.25
Amount (estimated) required for completion of existing project	55,375.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	40,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix E 12.)

13. Sumpawanus Inlet, New York.—[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.] The channel depth at the time of the adoption of the project varied from 5 feet in the bay at mean low water to 2 feet at the wharf at the mouth of the creek, a distance of a little over half a mile.

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The project for the improvement of this inlet, adopted in 1880, provides for dredging a channel 4,500 feet long and from 100 to 150 feet wide and 5 feet deep at mean low water, beginning at the 5-foot curve in the Great South Bay and extending up to the town of Babylon, Long Island, at an estimated cost of $23,115.

The amount expended under this project to June 30, 1894, was $7,000.

With this amount a channel 75 feet wide and 5 feet deep, from the steamboat wharf to a point 750 below it, was dredged, besides dredging two cuts, each 25 feet wide, alongside the wharf.

Outside of the cuts so made, and extending to the 5-foot curve in the bay, a shoal was left, on which the depth was only 4¾ feet.

There were no expenditures on account of this work during the fiscal year ending June 30, 1895.

Amount (estimated) required for completion of existing project.....	$16,115.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

(See Appendix E 13.)

14. Canarsie Bay, New York.—[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.] The original condition of the channel leading to Canarsie answered to a depth of 4½ feet mean low water.

The original project, adopted in 1879, provides for obtaining a navigable channel 6 feet deep at mean low water from Canarsie Landing to the deep water in Jamaica Bay by means of diking and the formation of a tidal basin at an estimated cost of $88,000. In the Annual Report of the Chief of Engineers, 1880, Part I, page 574, General Newton expressed a doubt as to adequate appropriations being made for carrying out the authorized project, and suggested that dredging be tried as an expedient.

The amount expended to the close of the fiscal year ending June 30, 1894, was $52,997.90.

With this amount two pile dikes have been built and maintained, one on the north side of the outer end of the channel, the other on the south side, their lengths being 1,058 and 820 feet, respectively; the channel dredged to a depth of 6 feet mean low water and width of 125 feet from Canarsie Landing to deep water in Jamaica Bay. In addition to this, several other improvements, not contemplated in the main project, but which added materially to the facility of navigation, viz, the excavation of a cut 250 feet long and 70 feet wide, with a depth of 6 feet, on the east side of the steamboat landing at Canarsie, and a cut at the end of the wharf at Canarsie Landing 1,300 feet long and 60 feet wide, with a depth of 4 feet, extending through to the southwest to connect with the southwest channel, the latter for the purpose of promoting tidal circulation.

Work is pending, by hired labor, operating the Government dredge *Alpha* and plant when available for this work.

July 1, 1894, balance unexpended.....	$2.10
Amount appropriated by act of August 17, 1894.....	2,000.00
	2,002.10
June 30, 1895, amount expended during fiscal year.....	2.10
July 1, 1895, balance unexpended.....	2,000.00

Amount (estimated) required for completion of existing project.....	33,000.00
Amount that can be profitably expended in fiscal year ending June 30,1897	2,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix E 14.)

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15. Sheepshead Bay, New York.—[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.] The original condition of the navigable channel was, for the entrance, a depth of a little over 2 feet at mean low water, and for the interior channel not less than 4 feet, except at two narrow bulkheads across said channel.

The originally adopted project (1879) was to deepen the entrance by means of converging jetties and to improve the interior channel by longitudinal dikes so placed as in some instances to form tidal reservoirs for the scour of the channel. The project was revised in 1881 and provides for excavating a channel at the outlet 100 feet wide and 6 feet deep at mean low water, to connect the bay with Dead Horse Inlet, and to dredge the interior channel; this was modified in February, 1889, the modified project contemplating a channel 5,350 feet long, 60 feet wide, and 5½ feet deep, mean low water, from the town of Sheepshead to within 1,080 feet of Dead Horse Inlet Cut, to connect with the channel of similar width and depth already existing at that point. The estimated cost of the existing project was $34,200.

The amount expended on this project to the end of the fiscal year ending June 30, 1894, was $25,967.95.

With this amount a channel had been dredged 100 feet wide and 6 feet deep at mean low water, connecting the east end of the bay with Dead Horse Inlet, and the interior channel dredged 60 feet wide and 5½ feet deep at mean low water for a distance of 3,400 feet from the town of Sheepshead toward Dead Horse Inlet. The first-mentioned channel, from a survey in 1887, was observed to have not maintained itself, having contracted to a width of 60 feet with an average depth of 5½ feet, mean low water.

Work was suspended in December, 1889, when funds were exhausted.

July 1, 1894, balance unexpended	$32.05
June 30, 1895, amount expended during fiscal year	32.05
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	8,200.00

(See Appendix E 15.)

16. Arthur Kill, New York and New Jersey.—[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.] A history of this improvement, which originated by special resolution in the Senate, is given in the Annual Report of the Chief of Engineers, 1889, Part I, page 819.

The improvement consists in the removal of a point of land near and to the south of the Staten Island Bridge, for the purpose of straightening the channel in order that the currents may be directed more truly in a direction perpendicular to the drawspan of the bridge, thus facilitating the passage of long tows. It is estimated to cost $26,500.

A statement of condemnation proceedings by the United States for acquiring the land needed for this improvement will be found in the Annual Report of the Chief of Engineers for 1890, Part I, page 843.

The sum of $21,470.74 had been expended up to June 30, 1894, in acquiring land and in dredging off about 1½ acres of the point, with a resulting increase of 225 feet in the channel width and a uniform mean low-water depth of 13 feet, where the land was originally 6 feet above that plane.

The amount expended during the fiscal year ending June 30, 1895, was $3,730.56, and was applied in dredging, operating the Govern-

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ment dredge *Alpha* and plant. About one-fourth acre, the balance of the point of land acquired by the United States, was removed to a depth of 13 feet at mean low water and the project completed.

The channel width at this point is now 730 feet, with a minimum depth of 13 feet at mean low water.

July 1, 1894, balance unexpended	$529.26
Amount appropriated by act of August 17, 1894	4,500.00
	5,029.26
June 30, 1895, amount expended during fiscal year	3,730.56
July 1, 1895, balance unexpended	1,298.70
July 1, 1895, outstanding liabilities	200.00
July 1, 1895, balance available	1,098.70

(See Appendix E 16.)

17. Channel between Staten Island and New Jersey.—[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.] Before this improvement was undertaken by the United States there was a navigable channel having a minimun depth of 9.2 feet from the deep water in Newark Bay to Elizabethport.

The first project for the improvement of the channel was made in 1873. This provided for dredging it to a depth of 16 feet for a width of 150 feet at its shallowest part and protecting the cut by parallel dikes. The estimated cost of this work was $443,210.

This project was changed in 1880 so as to dredge a channel 400 feet wide and 13 feet deep over the middle 200 feet of its width, leaving it but 12 feet deep over the remaining widths of 100 feet on each side. The estimated cost of this work was $125,705. In addition to this, it was proposed, should it be found necessary, to build four detached dikes along the line of the channel, two on the north and two on the south side, the estimated cost of which was $60,000, bringing the total estimated cost of the proposed improvement up to $185,705. Subsequently it was decided to give the channel 13 feet depth for its full width of 400 feet, increasing the estimate to $210,000.

A modification of this project, having in view the abandonment of the dikes, was submitted May 9, 1889, and was approved by Department letter dated May 15, and a further modification calling for a uniform channel depth of 14 feet at mean low water over the entire width of 400 feet was approved October 20, 1890.

The amount expended to June 30, 1894, was $199,970.88.

With this amount 2,237 feet of dike was built, the channel dredged throughout its entire projected length to a mean low-water depth of 13 feet, with widths varying from 300 to 350 feet, and in the vicinity of the bend at the Corner Stake Light for a distance of 3,000 feet the width had been increased to 400 feet, with mean low-water depths of from 13 to 14 feet.

A survey made in November, 1893, shows that the 300 to 350 foot channel between Shooters Island and the Corner Stake Light has contracted in places to a width of about 200 feet and in the bend at the Stake Light to a width of about 140 feet.

The amount expended during the fiscal year ending June 30, 1895, was $19,762.32, and was applied in dredging, operating the Government dredge *Alpha* and plant. Eighty-six thousand six hundred and sixty-seven cubic yards of material was removed from the channel and deposited at sea, giving an average increase of 165 feet in the channel width for a distance of 2,600 feet in the vicinity of the Corner Stake Light.

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After dredging, the channel width varied from 250 feet to 400 feet, and the depth exceeded 14 feet at mean low water.

July 1, 1894, balance unexpended	$14,029.12
Amount appropriated by act of August 17, 1894	6,000.00
	20,029.12
June 30, 1895, amount expended during fiscal year	19,762.32
July 1, 1895, balance unexpended	266.80
Amount (estimated) required for completion of existing project	40,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix E 17.)

18. Passaic River, New Jersey.—[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.] This river is being improved under two separate projects, the first applying to the river below Center street bridge, Newark, to and beyond the shoals in Newark Bay, a distance of 7⅞ miles, and the second to the upper course of the river from Center street bridge as far as Passaic, a distance of 8 miles. The most recent appropriation was, however, made in a single sum for the entire river, and the two projects will hereafter be united so that the funds can be expended at those parts of the river most urgently needing control or repair in the interests of navigation.

a. Below Newark.—The lower portion of the river, from Center street bridge to Newark Bay, was first surveyed by the Engineer Department in 1879. The greatest depth in the channel at a point above the Elbow Beacon was only 7.1 feet and in many places the greatest depth was 7.5 feet at mean low water.

A project was adopted, based on this survey, providing for obtaining by diking and dredging a channel 200 feet wide and 10 feet deep at mean low water, from the Center street bridge to Newark Bay, at a cost of $232,875.

This project was modified in 1884, pursuant to the river and harbor act of that year, providing for extending the dike at the mouth of the river into the bay a distance of 12,000 feet and for dredging a channel across the shoal in Newark Bay 200 feet wide and 10 feet deep at mean low water, increasing the original estimate to $353,875.

The amount expended to June 30, 1894, was $266,582.95.

With this amount 6,205 feet of dike had been built and maintained and the channel through the shoal in the bay and the channel up the river as far as Center street bridge, Newark, dredged to the required dimensions.

The amount expended below Newark during the fiscal year ending June 30, 1895, inclusive of outstanding liabilities, was $14,048.07, and was applied to dredging and to dike protection. Thirty-five thousand cubic yards of material was removed from the channel below the bridge of the Central Railroad of New Jersey and placed upon the embankment behind the dike in Newark Bay. The channel for a distance of 2,700 feet was given a width of 200 feet, an increase from 50 feet, and a depth of 10 feet at mean low water. One thousand two hundred and forty-nine cubic yards of stone was brought from the Raritan River for revetment at the dike.

b. Above Newark.—Before its improvement was undertaken the upper part of the river had a navigable 6-foot channel, except at Middle, Belleville, Rutherford Park, and Holzman bars, where the depths were 4.5 feet, 3.9 feet, 3 feet, and 3.5 feet, respectively.

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The project of improvement was adopted in 1872, and provided for a channel across and above the shoals from 7½ to 6 feet deep, mean low water, and from 200 to 50 feet wide, to be obtained by dredging and diking, at a cost of $123,924. It was modified in 1885 by extending the channel below Middle Bar 1,500 feet to the Erie Railroad bridge, increasing the estimate to $129,000, which was further increased in 1886 to $133,762. A further modification, to include the removal of Third River Bar, the redredging of bars formed by freshets, and removal of bowlders at various points in the river, increasing the estimate to $193,822, was approved October 6, 1890.

The amount expended to June 30, 1894, was $145,331.22, with which channels had been dredged to the requisite depth, with widths of from 60 to 75 feet, a channel through Third River Bar dredged to the required depth, with width of 100 feet for a distance of 800 feet, and below this bar the channel was increased in width by 40 feet with the same depth for a distance of 700 feet, and by 20 feet for a farther distance of 245 feet, giving a continuous channel through this reach having a width of 100 feet and a depth of 6 feet, mean low water. In addition a channel through Belleville Bar was completed to a width of 100 feet and a mean low-water depth of from 6 to 7 feet.

The channel through Rutherford Park Bar was given a mean low-water depth of 6 to 8 feet and a width of 85 to 100 feet for a distance of 1,035 feet, and the channel through Holzman Bar given a similar mean low-water depth and widened 35 feet for a distance of 418 feet. The channels are now in good condition for 6-foot navigation.

The amount expended above Newark during the fiscal year ending June 30, 1895, inclusive of outstanding liabilities, was $5,903.33, and was applied to dredging, removing 4,162.16 cubic yards of material from Lime Kiln Bar.

This entire improvement extends over a distance of 16 miles, and serves a commerce estimated at more than 1,250,000 tons per annum. Over 30,000 vessels annually pass the draw of the lower bridge.

The amount that can be profitably expended during the fiscal year ending June 30, 1897, in maintaining and enlarging the channel dimensions is $15,000.

July 1, 1894, balance unexpended		$11,435.83
Amount appropriated by act of August 17, 1894		15,000.00
		26,435.83
June 30, 1895, amount expended during fiscal year		13,022.32
July 1, 1895, balance unexpended		13,413.51
July 1, 1895, outstanding liabilities	$5,167.25	
July 1, 1895, amount covered by uncompleted contracts	1,761.83	
		6,929.08
July 1, 1895, balance available		6,484.43
Amount (estimated) required for completion of existing project		109,347.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		15,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix E 18.)

19. Elizabeth River, New Jersey.—[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.] This stream, which is 2⅝ miles in length from its mouth to the head of navigation, at Broad street, Elizabeth, has a width of from 50 to 90 feet, and before its improvement the wharves in the city could only be reached at high water by vessels drawing less than 4 feet; its commerce was

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estimated at 45,000 tons annually. The range of the tide was about 4.7 feet at its mouth and 3.4 feet at Bridge street.

The project for the improvement was adopted in 1878, and provides for obtaining, by dredging, a channel 60 feet wide and 7 feet deep at high water from the mouth of the river to the head of navigation, at an estimated cost of $25,530; this was increased in 1882 to $43,160, the increase being due to advanced prices.

The amount expended under this project to June 30, 1894, was $34,501.47.

With this amount the channel had been dredged in 1883 to the required depth to within 1,000 feet of Broad street bridge, but soon became obliterated by reason of deposits of silt and sewage refuse.

It was redredged in 1891, shoals being removed from the river at the bend above South street, at South street bridge, at John street, at the bend in the river below John street, and at the New York and Long Branch Railroad bridge to a depth of 7 feet at mean high water, with widths of 30 to 50 feet, giving a 7-foot mean high-water channel with widths varying from 30 to 50 feet from the mouth of the river to within 900 feet of Bridge street bridge in the town of Elizabeth.

A survey made in November, 1892, indicated a channel from 30 to 50 feet wide extending from the mouth to Bridge street bridge, the head of navigation, with mean high-water depths of from less than 5 feet to more than 7 feet.

Subsequent work consisted in dredging the channel from the bend above South street bridge to within 125 feet of Bridge street bridge, a distance of about 900 feet, to a width of 45 feet and mean high-water depth of 7 feet, removing 5,200 cubic yards of material, principally shale and gravel.

The amount expended during the fiscal year ending June 30, 1895, was $2,498.53, and was applied to the payment of outstanding liabilities and to office expenses.

Failure to obtain satisfactory offers for expending the appropriation made in the river and harbor act of August 17, 1894, during the season favorable for this work, made necessary, for sanitary reasons, the postponement of operations until the fiscal year ending June 30, 1896.

July 1, 1894, balance unexpended	$2,498.53
Amount appropriated by act of August 17, 1894	3,000.00
	5,498.53
June 30, 1895, amount expended during fiscal year	2,498.53
July 1, 1895, balance unexpended	3,000.00
Amount (estimated) required for completion of existing project	3,160.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	3,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix E 19.)

20. Rahway River, New Jersey.—[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.] In its original condition the Rahway River had a depth of 8 feet and more at mean high water from its mouth to Bricktown, 3⅝ miles; 7 feet to Edgar Dock, 4⅛ miles; 4.4 feet to Milton avenue bridge, 4¾ miles; and 4 feet to Main street bridge, 5 miles, in the town of Rahway. Its commerce was estimated at 120,000 tons, and three attempts had been made to establish a line of steamboats on the river, but had failed on account of the bad condition of the stream.

The original project for its improvement was adopted in 1878, and provides for dredging a channel 125 feet wide and 8 feet deep, at high

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water, from Bricktown to Milton avenue bridge, and 100 feet wide from that point to Main street bridge, at an estimated cost of $66,250.

The amount expended on this improvement to June 30, 1894, was $37,000.

With the above amount the channel had been given a depth of 7 feet at mean high water, and width of from 100 to 50 feet to within 550 feet of the head of navigation.

There has been no appropriation for this work since 1882, and there have been no funds for expenditure since the fiscal year ending June 30, 1890. The channels have reverted nearly to their original condition.

{ Amount (estimated) required for completion of existing project..... $29,250.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.

(See Appendix E 20.)

21. Raritan River, New Jersey.—[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.] Before its improvement by the United States the Raritan River had a depth of 8.5 feet at "The Stakes," 3 miles; of 6.5 feet at the "Middle Grounds," 4½ miles; of 7.5 feet at Whitehead Sand Dock, 8½ miles; and between this point and New Brunswick, 12¼ miles above the mouth, the channel was obstructed by a number of rocky shoals with depths of from 8.4 to 6.9 feet at mean low water. The city of New Brunswick and the Delaware and Raritan Canal, which terminates here, together with extensive brickyards on the South River, did a large commerce, estimated in 1871 at 3,053,857 tons.

The present project was adopted in 1874, and provides for obtaining by diking and dredging, and where necessary by drilling and blasting rock, a channel 200 feet wide and 10 feet deep, mean low water, from the mouth to New Brunswick, at a cost of $2,093,662.05. It was modified in 1881, pursuant to the river and harbor act of that year, by adding to it the dredging of the South Channel, about 13,000 feet long, 100 feet wide, and 5½ feet deep at mean low water, from Kearney Dock to Crab Island.

The amount expended to June 30, 1894, under this project was $600,849.04.

The above amount was expended in the construction and maintenance of certain dikes required by the project at "The Stakes" and "Middle Grounds," in dredging channels 200 feet wide and 12 feet deep at mean low water at these points, and in blasting and dredging a channel of the same dimensions across the rocky shoal at Whitehead Sand Dock, and thence up the river with a width of 100 feet and depth of 10 feet to within 1,500 feet of the canal lock at New Brunswick, and the channel to Acken Dock redredged to a mean low-water depth of 6 feet and width of 50 feet from Raritan River to Acken Wharf, a distance of 600 feet. Under two special allotments made for it in the acts of March 3, 1881, and August 2, 1882, the South Channel was dredged to the required depth for a distance of 4,000 feet. The commerce of the river is reported for the calendar year 1894 to be 1,138,692 tons.

The amount expended during the fiscal year ending June 30, 1895, inclusive of outstanding liabilities, was $18,069.19, and was applied to the breaking of rock, by contract, and to the operation of the Government dredge *Alpha* and plant in removing rock so broken; 7,442 tons of rock (estimated) was broken and 2,955 tons removed from a section 400 feet long and 100 feet wide, in continuation of the channel previously completed to within 1,500 feet of the canal lock at New Brunswick, with a width of 100 feet and depth of 10 feet at mean low water.

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The broken rock on the section was removed to a depth of 10 feet at mean low water for a width of 60 feet and the rock over the remaining width of 40 feet broken free for dredging, extending the channel to within 1,100 feet of the canal lock, with a width of 60 feet and depth of 10 feet at mean low water.

July 1, 1894, balance unexpended		$10,400.96
Amount appropriated by act of August 17, 1894		20,000.00
		30,400.96
June 30, 1895, amount expended during fiscal year		10,340.74
July 1, 1895, balance unexpended		20,060.22
July 1, 1895, outstanding liabilities	$328.45	
July 1, 1895, amount covered by uncompleted contracts	7,400.00	
		7,728.45
July 1, 1895, balance available		12,331.77

Amount (estimated) required for completion of existing project	1,462,412.05
Amount that can be profitably expended in fiscal year ending June 30, 1897	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix E 21.)

22. South River, New Jersey.—[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.] Before the improvement of this stream was undertaken by the United States the navigation of the lower 2½ miles of its course had been abandoned and a private canal dredged from near Washington to Sayreville, on the Raritan River. In 1880, when the present project for improving the river was adopted, the mouth of the canal, on account of its faulty location, had shoaled considerably. Above Washington a depth of 2.7 feet existed to Bissetts, 3⅝ miles, and of 2.5 feet to Old Bridge, the head of navigation, 6¼ miles above the mouth of the canal at Sayreville.

The project adopted in 1880 provided for closing the river below the head of the canal, correcting the direction of the mouth of the latter, and obtaining, by diking and dredging, a depth of 8 feet, mean low water, to Washington, 6 feet to Bissetts, and 4 feet to Old Bridge, straightening the channel at two points by cutting across the meadow; estimated to cost $194,695. This was modified July 30, 1892, by omitting the proposed cut-off and dikes, and substituting therefor the dredging of the river between Washington and the Raritan River Railroad bridge, reducing the original estimate to $176,975.

The amount expended under this project to June 30, 1894, was $77,039.74.

With this amount, the direction of the mouth of the canal had been changed, the dikes below Washington completed and maintained, a small amount of dredging done on a shoal above Washington, a shoal at the mouth of Washington Canal removed, a channel dredged 60 feet wide through the canal and 50 feet wide across the shoal in the river below Washington, the channel between the turnpike bridge and Raritan River Railroad bridge dredged 50 to 100 feet wide and 6 feet deep, mean low water, and the channel for a distance of 350 feet above the bridge dredged to 4 feet, mean low water, and width of 70 feet. At Rourke Reach the channel was given a depth of 6 feet at mean low water, and width of 60 feet for a distance of 860 feet; in addition, a bar opposite Whitehead's brickyard was removed to a depth of 8 feet at mean low water, and width of 60 feet for a distance of 450 feet, and at the junction of the canal and South River a channel was excavated 350 feet long, 60 feet wide, and 6 feet deep at the same stage of the tide.

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The amount expended during the fiscal year ending June 30, 1895, inclusive of outstanding liabilities, was $4,833.81, and was applied to dredging, by contract and under open-market agreement, in maintaining the required depth of the project below the town of Little Washington; 15,147 cubic yards was removed from the channel, and there is now a depth of 8 feet at mean low water, and width of not less than 50 feet, between Little Washington and a point within the canal 1,000 feet below its head, and thence to Sayreville the depth is 6 feet.

July 1, 1894, balance unexpended	$960.26
Amount appropriated by act of August 17, 1894	5,000.00
	5,960.26
June 30, 1895, amount expended during fiscal year	4,826.08
July 1, 1895, balance unexpended	1,134.18
July 1, 1895, outstanding liabilities	7.73
July 1, 1895, balance available	1,126.45
Amount (estimated) required for completion of existing project	93,795.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix E 22.)

23. Keyport Harbor, New Jersey.—[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.] Keyport Harbor was originally accessible at low water only to vessels drawing less than 4 feet. Before its improvement was undertaken by the United States a 6-foot channel had been dredged at private expense, which had shoaled in 1872 to 5½ feet, and in 1882 to 5 feet, the range of the tide being 4.7 feet. A large commerce was carried on, however, valued at $2,932,000.

The project for the improvement was adopted in 1873, and provided for dredging a channel 4,700 feet long, 8 feet deep at mean low water, and 200 feet wide, from the steamboat dock to the 8-foot contour in Raritan Bay, at an estimated cost of $30,475. The revised estimate of 1884 was $40,475.

The amount expended on this improvement to the close of the fiscal year ending June 30, 1894, was $35,391.52.

With the above amount a channel was dredged in 1883 from the 8-foot depth in Raritan Bay to Keyport Wharf, a distance of 5,000 feet, with a width of 200 feet for the first 4,200 feet and 160 feet for the remainder. The channel did not prove permanent, having deteriorated to a width of 30 to 50 feet and mean low-water depth of 6 to 7 feet, and was redredged in 1893 to the projected mean low-water depth, with width of from 70 to 140 feet for a distance of 400 feet in front of Keyport Wharf; thence for a distance of 2,200 feet outward a cut 35 feet wide was made along the northerly side of the old channel.

The amount expended during the fiscal year ending June 30, 1895, was $28.05, for office expenses.

The amount available, appropriated by the river and harbor act of August 17, 1894, to complete the improvement is covered by existing contract, and the work, which is combined in one contract with that at other improvements now going on, will be executed during the fiscal year ending June 30, 1896.

The amount appropriated to complete the project will not suffice, owing to extensive shoaling in the dredged channel during suspension of operations. If the channel contemplated in the project is to be made and maintained additional funds will be required.

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July 1, 1894, balance unexpended	$83.48
Amount appropriated by act of August 17, 1894	5,000.00
	5,083.48
June 30, 1895, amount expended during fiscal year	28.05
July 1, 1895, balance unexpended	5,055.43
July 1, 1895, amount covered by uncompleted contracts	4,000.00
July 1, 1895, balance available	1,055.43

(See Appendix E 23.)

24. Mattawan Creek, New Jersey.—[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.] Before its improvement by the United States this small stream was obstructed at its entrance into Keyport Harbor by a mud flat, on which the best depth at the worst section was 3.1 feet at mean low water, though the 3-foot channel was too narrow and tortuous for use. Above this flat a good 4-foot channel existed to 1¼ miles above the mouth, and thence to the steamboat dock at Mattawan 3.5 feet, shoaling to 1.8 feet at the freight dock, 600 feet above, and 1⅞ miles from the mouth. The range of the tide is 4.7 feet. Notwithstanding the above difficulties, it carried commerce valued in 1880 at $800,000.

The project for this improvement was adopted in 1881, and provides for dredging a channel 4 feet deep at mean low water and 100 feet wide from the mouth to Winkson Creek, and thence 75 feet wide to the railroad bridge at Mattawan, 250 feet above the freight dock, at an estimated cost of $33,120.

To June 30, 1894, the amount expended under this project was $32,873.64.

With this amount channels had been dredged in 1881 and 1882 to the required depth from the mouth to the freight dock at Mattawan with widths varying from 100 to 30 feet, and in 1891 a cut 35 feet wide was redredged to the required depth along the northerly side of the channel for a distance of 1,420 feet upstream from the mouth of the creek.

A survey made in November 1892, showed that the channels dredged in 1881 and 1882 had almost reverted to their original condition, hence the appropriation made by river and harbor act of July 13, 1892, viz, $9,620, for completing the improvement in accordance with the approved plans would be insufficient for that purpose.

With this amount the channel between the mouth of the creek and steamboat dock at Keyport was redredged on its southerly side to a mean low-water depth of 4½ feet for a distance of 2,100 feet upstream from Keyport Dock, and given a width of 50 feet for the first 1,500 feet, with 25 feet for the remainder, and on its northerly side redredged to a similar depth with a width of 25 feet for a distance of 630 feet, extending from Keyport Dock upstream; from Winkson Creek to Mattawan steamboat dock the channel was redredged to a mean low-water depth of 4 to 5 feet and width of 50 feet for a distance of 4,000 feet.

The amount expended during the fiscal year ending June 30, 1895, was $8.32, for office expenses.

The amount available, appropriated by the river and harbor act of August 17, 1894, is covered by existing contract; and the work, which is combined in one contract with that at other improvements now going on, will be executed during the fiscal year ending June 30, 1896.

If it is the intention of Congress to complete the original project additional funds will be necessary, the expended estimate having been insufficient owing to the interval between partial allotments.

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July 1, 1894, balance unexpended	$246.36
Amount appropriated by act of August 17, 1894	3,000.00
	3,246.36
June 30, 1895, amount expended during fiscal year	8.32
July 1, 1895, balance unexpended	3,238.04
July 1, 1895, amount covered by uncompleted contracts	1,500.00
July 1, 1895, balance available	1,738.04
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	3,000.00

(See Appendix E 24.)

25. Shoal Harbor and Compton Creek, New Jersey.—[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.] Shoal Harbor is an indentation of the shore on the south side of Sandy Hook Bay, 5 miles west of the entrance to Shrewsbury River. It is bare at low water, and the water deepens so gradually outward that the 5-foot curve, mean low water, is only reached at a distance of 3,000 feet from the high-water line. Compton Creek, which flows into Shoal Harbor, is 5 to 6 miles long, with 3 to 5 feet of water in the lower reach. At one-quarter of a mile from its mouth it is crossed by a fixed bridge, which limits navigation. Between this bridge and the harbor there is a harbor of refuge of limited capacity, having a depth of 9 feet in places, to which fishing vessels resort when the tides allow them to cross the shoal at the entrance. The range of the tide is 4.5 feet.

The plan of improvement adopted in 1884 had in view the connection of the 5-foot mean low-water curve of the creek on the inside with the 5-foot curve of the bay by means of a dredged channel 150 feet wide, and the protection of this channel against shoaling by means of a timber dike placed on the west side of the harbor, at a total estimated cost of $64,130.

The total expenditure on this improvement to June 30, 1894, was $5,139.29, with which the channel was dredged in 1891 to a mean low-water depth of 4½ feet for a distance of 1,200 feet, beginning near the bulkhead at the mouth of the creek, with a width of 100 feet for the first 800 feet, and 70 feet for the remainder. A survey made in October, 1892, showed that this channel had deteriorated to widths of from 60 to 80 feet, and mean low-water depths of from 3.2 to 4.2 feet.

The amount expended during the fiscal year ending June 30, 1895 ($5,794.62), was applied to dredging 8,150 cubic yards of material from Shoal Harbor and placing it behind bulkheads. The length of the dredged channel is now 1,855 feet, with a width of 75 feet and depth of 4 feet at mean low water, and it extends out to a depth of 1 foot at mean low water in Raritan Bay.

July 1, 1894, balance unexpended	$2,860.71
Amount appropriated by act of August 17, 1894	3,000.00
	5,860.71
June 30, 1895, amount expended during fiscal year	5,794.62
July 1, 1895, balance unexpended	66.09
Amount (estimated) required for completion of existing project	53,130.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	3,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix E 25.)

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26. Shrewsbury River, New Jersey.—[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.] When the present project for this improvement was adopted in 1879 the river was obstructed by a number of shifting sand bars, which had caused the complete suspension of navigation in the South Branch, and only permitted the passage of vessels engaged in commerce up the North Branch at or near high water. A considerable trade was carried on, however, even under these difficult conditions.

The project originally adopted was to dredge a channel 6 feet deep at mean low water, and from 300 to 150 feet in width across the shoals from the mouth to Red Bank on the North Branch, 8 miles, and Branchport on the South Branch, 9 miles, maintaining these channels by longitudinal dikes. This project has not been modified as to the end sought, but estimates of the diking, dredging, and cost have been increased from time to time. The amount now stands at $254,562.

The amount expended on this project to June 30, 1894, was $234,423.10.

With this amount 13,437 linear feet of diking has been built and maintained, and channels of the required depth, and widths of from 60 to 200 feet, dredged through all shoals obstructing navigation.

Shoals have been formed in the channels at Lower Rocky Point, Barley Point, and Upper Rocky Point in the North Branch, and at Bellevue and Jumping Point in the South Branch, making repeated dredging necessary to maintain the depth at these localities.

No expenditures have been made since 1891 in continuation of the permanent improvement, all available funds being required to maintain existing dikes and dredged channels.

The amount expended during the fiscal year ending June 30, 1895, inclusive of outstanding liabilities, was $3,688.14, and was applied to the repair of the dike at the outer bar and to dredging, opening navigation in the North Branch to regular traffic in the spring by the removal of 3,875 cubic yards, in making a cut 150 feet wide, 6 feet deep at mean low water and 140 feet long, through a bar in the channel above Upper Rocky Point.

An extension of the system of training dikes along the river is essential to the permanency of the dredged channels, and would be a more economical expenditure of the estimate than that under the present method of annual dredging, made necessary by the small amounts appropriated irregularly for the improvement.

July 1, 1894, balance unexpended	$76.90
Amount appropriated by act of August 17, 1894	5,000.00
	5,076.90
June 30, 1895, amount expended during fiscal year	3,642.77
July 1, 1895, balance unexpended	1,434.13
July 1, 1895, outstanding liabilities	45.37
July 1, 1895, balance available	1,388.76
Amount (estimated) required for completion of existing project	15,062.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix E 26.)

27. Manasquan (Squan) River, New Jersey.—[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.] In its original condition this stream had a depth of from 4 to 6 feet at mean low water for several miles above its mouth, but was

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obstructed at its outlet into the ocean by a sand spit, which had deflected the stream into a channel parallel with the beach, communicating with the ocean across shifting sand bars, on which the best depth did not exceed 1½ feet at mean low water; mean range of tide, 2.4 feet. In severe storms this channel was sometimes entirely closed by sand, remaining so until the fresh water in the river had accumulated sufficiently to force a new outlet. Under these conditions the river could not be used by commerce.

The project for its improvement was adopted in 1879, and contemplated dredging the lower river and obtaining, by means of jetties, a permanent outlet nearly at right angles to the beach, with a depth of 6 feet at mean low water, at an estimated cost of $52,120. This was increased to $72,000 in 1882, the increase being due to advanced prices and to a proposed increase in the length of the jetties.

The amount expended under this project to June 30, 1894, was $39,000.

With this amount two jetties had been constructed, but neither to its full length, appropriations having ceased in 1882. No permanent improvement had been effected.

An appropriation of $2,000 was made in the act of September 19, 1890, to be expended in the removal of obstructions placed by the Government at the mouth of the river, if, in the discretion of the Secretary of War, the same should be done. There were no expenditures during the fiscal year ending June 30, 1894, as the removal of the obstructions alluded to in the act of September 19, 1890, was, in the opinion of the engineer in charge, deemed unnecessary, and so reported under date of December 19, 1890, and was approved by the Secretary of War December 30, 1890.

July 1, 1894, balance unexpended	$2,000.00
July 1, 1895, balance unexpended	2,000.00
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	31,000.00

(See Appendix E 27.)

28. Removing sunken vessels or craft obstructing or endangering navigation.—A contract was entered into, March 13, 1895, for the removal of the wreck of the U. S. Engineer dredge *Flood Rock*, sunk off Sunken Meadow, East River. This contract is still in force.

The barge *Milton* was wrecked on reef off Sunken Meadow, East River, and lay in 85 feet of water, with 50 feet over her deck. The hull of the vessel has been destroyed and no longer offers any obstruction to the currents.

The wreck of the steamer *Canonicus* was removed from Kill van Kull June 4, 1895, under agreement with John S. Bundick, at a cost of $2,500, including inspection.

The total amount expended during the year upon removal of wrecks is $3,203.30.

(See Appendix E 28.)

EXAMINATIONS AND SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations and survey of the following localities required by the river and harbor act of August 17, 1894, were made by the local engineer officers and reports thereon submitted:

1. Preliminary examination of Peekskill Harbor, New York.—Lieutenant-Colonel Gillespie submitted report of examination November 26,

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1894. He is of opinion that the locality is worthy of improvement in so far as relates to the excavation of a channel along the entire wharf front, connecting north and south with the deep-water channel of the Hudson River, excluding any work of construction upon the outlying flats, and his views are concurred in by this office. No survey is necessary at this time, sufficient data being already at hand for preparation of plan and estimate of cost of improvement. The report was transmitted to Congress and printed in House Ex. Doc. No. 37, Fifty-third Congress, third session. (See also Appendix E 29.)

2. Preliminary examination of Carrls River, New York.—Captain Casey submitted report of examination October 20, 1894. It is his opinion, concurred in by the Division Engineer, Col. H. L. Abbot, Corps of Engineers, and by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 40, Fifty-third Congress, third session. (See also Appendix E 30.)

3. Preliminary examination of Gravesend Bay, New York.—Lieutenant-Colonel Gillespie submitted report of examination November 19, 1894. It is his opinion, concurred in by this office, that the locality is not worthy of improvement at the present time. The report was transmitted to Congress and printed in House Ex. Doc. No. 31, Fifty-third Congress, third session. (See also Appendix E 31.)

4. Preliminary examination of West Branch of Newtown Creek, New York, from Metropolitan avenue bridge to the head of navigation.—Lieutenant-Colonel Gillespie submitted report of examination November 30, 1894. In his opinion this portion of the West Branch of Newtown Creek is not worthy of improvement by the General Government within the meaning and intent of the act of August 17, 1894, and his views are concurred in by this office. The report was transmitted to Congress and printed in House Ex. Doc. No. 32, Fifty-third Congress, third session. (See also Appendix E 32.)

5. Preliminary examination of Rahway River, New Jersey, to report upon the desirability of placing locks in the mouth of said river and the cost of same.—Lieutenant-Colonel Gillespie submitted report of examination November 14, 1894. In his opinion, concurred in by this office, the locality is not worthy of improvement so far as relates to the desirability of placing locks in the mouth of the river. The report was transmitted to Congress and printed in House Ex. Doc. No. 30, Fifty-third Congress, third session. (See also Appendix E 33.)

6. Preliminary examination of Elizabeth River, New Jersey, to report upon the desirability of placing locks in the mouth of said river and the cost of same.—Lieutenant-Colonel Gillespie submitted report November 14, 1894. He considers the locality not worthy of improvement so far as relates to the desirability of placing locks in the mouth of said river, and this opinion is concurred in by this office. The report was transmitted to Congress and printed in House Ex. Doc. No. 41, Fifty-third Congress, third session. (See also Appendix E 34.)

7. Preliminary examination of inlet at mouth of Shark River, New Jersey, for harbor of refuge.—Captain Casey submitted report of examination October 23, 1894. It is his opinion, concurred in by the division engineer and by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 73, Fifty-third Congress, third session. (See also Appendix E 35.)

8. Survey of Raritan Bay, New Jersey, between South Amboy and Great Beds Light, with a view to deepening the channel to 21 feet at mean

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low water.—The act of August 17, 1894, made appropriation for continuing improvement of harbor at Raritan Bay, New Jersey, the appropriation to include a survey between South Amboy and Great Beds Light, with a view to deepening the channel to 21 feet at mean low water. February 2, 1895, Lieutenant-Colonel Gillespie submitted report of the results of the survey thus provided for. He states that the length of the waterway between the 21-foot curves is 7,300 feet, approximately, and the amount of material necessary to be removed to give throughout this length a width of 300 feet and a depth of 21 feet at mean low water is estimated to be 680,000 cubic yards. If the work be done in one year, at the existing contract price of 17½ cents per cubic yard the cost of completion of the project, adding 10 per cent for contingencies, will be $130,000, approximately. The report was transmitted to Congress and printed in House Ex. Doc. No. 298, Fifty-third Congress, third session. (See also Appendix E 36.)

IMPROVEMENT OF RIVERS AND HARBORS IN SOUTHERN NEW JERSEY, OF DELAWARE RIVER AND BAY, AND OF WATERS TRIBUTARY THERETO, NEW JERSEY, PENNSYLVANIA, AND DELAWARE.

This district was in the charge of Maj. C. W. Raymond, Corps of Engineers, with Lieut. Spencer Cosby, Corps of Engineers, under his immediate orders since July 5, 1894; Division Engineer, Col. Henry L. Abbot, Corps of Engineers.

1. Delaware River, New Jersey and Pennsylvania.—Trenton, the head of natural navigation on the Delaware River, is about 30 miles above the upper part of the port of Philadelphia. In its original condition this part of the river was obstructed by shoals at the following localities: Between Bordentown and Trenton, a distance of about 5 miles, a narrow and circuitous channel existed, which carried from 3 to 6 feet at mean low water; at Kinkora Bar, about 9 miles below Trenton, a shoal carrying 7½ feet, and at Five Mile Bar, at the upper part of Philadelphia, a shoal across the Pennsylvania channel carrying only 3 to 4 feet at mean low water, there being, however, 13 feet of water past Five Mile Bar, in the New Jersey channel, passing south of Petty Island.

Below Philadelphia the river, in its original condition, presented obstructions at Mifflin Bar, which reduced the depth at mean low water to 17 feet; at Schooner Ledge and Cherry Island Flats to 18 feet; at Bulkhead Shoal and Dan Baker Shoal to about 20 feet. In that part of the Delaware River between Trenton, N. J., and Bridesburg, Pa., efforts in the past have been directed toward relieving commerce from the obstructions which exist in the upper 9 miles of the river, and deepening the channel across Kinkora Bar.

Previous to 1885 the efforts to improve the river between Philadelphia and the bay were confined to dredging, except at Schooner Ledge, where solid rock was removed under appropriations for special localities, and also under general appropriations for the Delaware River below Bridesburg.

A Board of Engineers, convened by direction of the Secretary of War for the purpose of considering the subject of permanent improvement of Delaware River and Bay, recommended, under date of January 23, 1885, the formation of a ship channel from a point opposite Philadelphia, and about midway between the American Ship-building Company's yard and the Gas Trust wharf, to deep water in Delaware Bay, having a least width of 600 feet and a depth of 26 feet at mean

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low water. The formation of such a channel is to be obtained, except at Schooner Ledge, where rock would require to be removed, by regulating the tidal flow by means of dikes, with recourse to dredging, where necessary, as an aid to such contracting and regulating works.

The estimated cost of obtaining a channel of the above dimensions is about $2,425,000, which covers the estimated cost of the permanent improvement of the Delaware River between the upper part of Philadelphia and deep water in the bay. This estimate of cost does not include the improvement of Philadelphia Harbor, which is a separate project. With the present requirements of commerce above Philadelphia it is not considered that the part of the river lying between Trenton and Bridesburg demands any further improvement.

The entire amount expended on the improvement of the Delaware River from 1836 to June 30, 1894, under appropriations both for special localities and the general river, was $2,214,208.89, of which $118,500 was expended on that part of the river between Trenton and the upper part of Philadelphia. As a result of this expenditure there had been formed at the latter date a channel of navigable width and 7½ feet deep at mean low water through the bars between Bridesburg and Bordentown; a channel across Kinkora Bar 7½ feet deep; a channel across Five Mile Bar 270 feet wide and from 13 to 15 feet deep; a channel from 200 to 400 feet wide and from 24 to 26 feet deep through the shoal areas at Port Richmond; a channel across Mifflin Bar 100 feet wide and from 24 to 24.6 feet deep; a channel through Schooner Ledge 220 feet wide and 24 feet deep, except over a small area recently discovered, where the depth is reduced to 23 feet at mean low water; a channel through Cherry Island Flats 200 to 300 feet wide and from 19 to 27 feet deep, and a channel across Bulkhead Bar 350 feet wide and from 24 to 26 feet deep.

The channel between Philadelphia and Camden across Smith Island Bar had been improved by the formation of a dredged cut, protected by revetment, so as to give a channel 100 feet wide with a minimum depth of 6 feet at mean low water. The revetment on both sides of this channel has been removed in the work of improving the harbor of Philadelphia.

During the fiscal year ending June 30, 1895, the sum of $58,704.13 was expended in surveys, examinations, the repair of the dike at Bulkhead Bar, dredging at Bulkhead Bar, repair of the dike at Mifflin Bar, dredging at Perriwig Bar, and removal of bow of wrecked steamship *Allegheny*, making a total expenditure since 1836 of $2,272,913.02, of which $920,913.02 has been expended on the present project.

The changes during the past fiscal year are summarized as follows:

At Perriwig Bar a channel 200 feet wide and 6 feet deep at mean low water is being dredged. The channel across Kinkora Bar has now a minimum depth of 9 feet at mean low water. At Five Mile Bar the dike has formed a channel of ample width, having a minimum depth of 14.3 feet at mean low water. At Mifflin Bar the channel has a least depth of 25.6 feet at mean low water. The 24-foot channel has now a minimum width of 125 feet. At Cherry Island Flats, the channel dredged in 1893, 400 feet wide and from 25 to 27 feet deep, has shoaled over a distance of about 4,000 feet, the minimum depth being 20.2 feet at mean low water. The minimum depth, however, is now greater than it was in November, 1893, showing that since that time scour has been in progress. At Bulkhead Bar about one-third of the width of the projected 600-foot channel has been dredged through the bar to a depth of 26 feet at mean low water.

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July 1, 1894, balance unexpended		$87,791.11
Amount appropriated by act of August 17, 1894		170,000.00
		257,791.11
June 30, 1895, amount expended during fiscal year		58,704.13
July 1, 1895, balance unexpended		199,086.98
July 1, 1895, outstanding liabilities	$10,623.41	
July 1, 1895, amount covered by uncompleted contracts	10,702.82	
		21,326.23
July 1, 1895, balance available		177,760.75

Amount (estimated) required for completion of existing project	1,305,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	250,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix F 1.)

2. Harbor between Philadelphia, Pa., and Camden, N. J.—At the time of adoption of the present project the islands in the Delaware River between Philadelphia and Camden compelled the flood and ebb currents to pursue different paths, narrowed the existing channels, and prevented the extension of wharves necessary for the purposes of commerce. The plan of improvement originally adopted by Congress provides for the removal of Smith and Windmill islands and a part of Petty Island, and the formation of a channel of ample depth and about 2,000 feet in width from Kaighn Point to Fishers Point. The project contemplates the advance of wharves and bulkheads on both the Philadelphia and Camden shores during the progress of the work. The excavation is to be done by the General Government. The advance of wharves and bulkheads is under the control of the local authorities and private owners, a portion of the material to be removed by the Government being considered available for the necessary filling. The estimated cost of the work to be done by the United States, exclusive of the cost of the islands, is $3,500,000.

The project was modified by Congress in the sundry civil act approved March 3, 1891, by authorizing a change in the line limiting the excavation on Petty Island, and by requiring that all material removed under appropriations made to that date should be deposited and spread on League Island. The latter requirement was revoked by Congress in the river and harbor act approved July 13, 1892, which provides that the material removed may be deposited in any place or places approved by the engineer officer in charge of the work.

The amount expended under the project to June 30, 1894, was $911,327.36. At that date 22,664 linear feet of revetment had been removed, 5,842,927 cubic yards of material, scow measurement, had been excavated by dredging, and 1,636,087 cubic yards had been deposited on League Island.

During the fiscal year ending June 30, 1895, 2,184 linear feet of piling and revetment was removed from Petty Island and the cross channel north of Smith Island; 4,597,365 cubic yards of material, scow measurement, was dredged from Smith and Petty islands and the adjacent shoals, and 719,526 cubic yards, scow measurement, was deposited on League Island. The removal of piling and revetment was entirely completed.

Smith and Windmill islands were dredged to an average depth of 18 feet below mean low water, and the north side of Petty Island was

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dredged back so as to make the average low-water width of the Pennsylvania channel at that locality about 1,700 feet. Work was carried on under a contract with the American Dredging Company, dated June 1, 1893.

During the fiscal year ending June 30, 1896, it is expected that the filling on League Island will be completed, and that at least 2,700,000 cubic yards of material, scow measurement, will be excavated and deposited.

July 1, 1894, balance unexpended		$329,672.64
Amount appropriated by sundry civil act approved August 18, 1894		250,000.00
Amount appropriated by sundry civil act approved March 2, 1895		850,000.00
		1,429,672.64
June 30, 1895, amount expended during fiscal year		706,012.63
July 1, 1895, balance unexpended		723,660.01
July 1, 1895, outstanding liabilities	$215,685.09	
July 1, 1895, amount covered by uncompleted contracts	507,974.92	
		723,660.01

Amount (estimated) required for completion of existing project	1,159,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	1,000,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix F 2.)

3. Schuylkill River, Pennsylvania.—When the work of improvement was commenced in 1870 there was a channel of entrance into the mouth of the river carrying a depth of only 10 feet at mean low water.

The original project under which work was commenced in 1870 proposed the formation of a channel 100 feet wide, with a depth of 20 feet, from the mouth of the river to Gibson Point, about 4 miles, and a depth of 18 feet thence to Chestnut street bridge, in Philadelphia, about 3 miles.

In 1875 and 1883 this project was amended so as to increase the low-water channel between the mouth and Girard Point, a distance of about 1 mile, to 400 feet wide and 24 feet deep, and from Girard Point to Gibson Point, about 3 miles, to 250 feet wide and 20 feet deep. In 1892 the project was again modified so as to provide for the construction of dikes to maintain a navigable depth at the mouth. The estimated cost of the entire improvement is $529,959.

The amount expended upon this project to June 30, 1894, was $477,884.78, and had resulted in the formation of a channel about 150 feet wide and from 18 to 21.3 feet deep at mean low water across the bar at the river's mouth; a channel about 250 feet wide and from 20 to 24 feet deep from inside the bar to Gibson Point, except at Yankee Point where the width is 300 feet, and between Penrose Ferry bridge and Yankee Point, where the 20-foot channel has narrowed to from 50 to 200 feet; and thence to Chestnut street bridge a channel of navigable width and from 14 to 20 feet deep.

During the fiscal year ending June 30, 1895, the sum of $1,273.67 was expended under existing contract in the extension of the pile dike, and in the repair of the earthen dike at the mouth of the river and planting willows along it.

The depth of the channel over the bar at the mouth has remained about the same, the minimum depth being 21.3 feet at mean low water.

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July 1, 1894, balance unexpended		$7,115.22
Amount appropriated by act of August 17, 1894		20,000.00
		27,115.22
June 30, 1895, amount expended during fiscal year		1,273.67
July 1, 1895, balance unexpended		25,841.55
July 1, 1895, outstanding liabilities	$423.91	
July 1, 1895, amount covered by uncompleted contracts	19,870.52	
		20,294.43
July 1, 1895, balance available		5,547.12
Amount (estimated) required for completion of existing project		24,959.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix F 3.)

4. Ice harbor at Marcus Hook, Pennsylvania.—This work, in its present plan, was commenced in 1866, the object being to provide a harbor in the Delaware River to protect vessels against moving ice.

In 1785 the Commonwealth of Pennsylvania built, for the convenience of commerce, piers at Marcus Hook, extending from the shore line into the river. It is assumed that at some subsequent time these shore piers were turned over to the United States, since in 1829 an appropriation was made of $5,000 for repairing these piers, improving the harbor, and removing obstructions. No further appropriation was made until 1866.

At this latter date the project was adopted for the construction of detached piers in the harbor, consisting of stone superstructures upon crib foundations filled with stone, together with the deepening of the harbor by dredging.

In 1881 it was proposed to increase the area of the harbor by the construction of a bulkhead about 1,800 feet in length parallel to the shore line and about 150 feet outside of high-water line, and the deepening of this added area by dredging. Nothing was done toward the carrying into effect of the modification of 1881, on account of the objections of some of the abutting property owners, and in 1881 this hitherto proposed modification was abandoned and an increased depth proposed for the areas protected by the detached piers outside of the natural shore line of the river.

The amount expended from 1866 to June 30, 1894, was $211,052.61, which was applied to the construction of two landing piers and seven detached ice piers, the deepening by dredging of the protected area, the placing and replacing of mooring piles, repairs to landing piers and mooring piles, and the necessary examinations.

During the past fiscal year no work was done. Necessary repairs will be made during the current working season.

July 1, 1894, balance unexpended	$2,947.39
July 1, 1895, balance unexpended	2,947.39

(See Appendix F 4.)

5. Ice harbor at head of Delaware Bay, Delaware.—The act of August 2, 1882, appropriated $25,000 for the commencement of work on the ice harbor at the head of Delaware Bay, to include the removal of some sunken piers, the remains of an old ice harbor, in the channel east of Reedy Island, Delaware.

The desirability of an ice harbor at the head of Delaware Bay has been long recognized, but until the improvement of the main ship

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channel shall have been materially advanced it is believed that appropriations can be applied, with better results to commerce, to the improvement of the channel rather than to the formation of an ice harbor suited to the requirements of the case. As to location, the prevailing judgment would place the ice harbor at or very near Liston Point, but since the works already planned for the improvement of the channel in this part of the river involve the construction of about 11 miles of dikes, the changes which may result from such extensive constructions rendered the prior location of an ice harbor hazardous.

The amount expended to June 30, 1894, was $8,763.07, of which $3,700 was applied to the removal of the sunken piers back of Reedy Island, as provided in the act of August 2, 1882, making the appropriation of $25,000. The balance was expended in surveys, examinations, preliminary studies, and office expenses.

During the fiscal year ending June 30, 1895, no expenditures were made.

July 1, 1894, balance unexpended	$16,236.93
July 1, 1895, balance unexpended	16,236.93

(See Appendix F 5.)

6. Construction of iron pier in Delaware Bay, near Lewes, Del.—The original project for this work proposed the construction of a landing pier about 1,700 feet in length, extending from the shore south of the breakwater into Delaware Bay to a depth of 22 feet at mean low water, the pier to consist of a substructure of wrought-iron screw piles surmounted with a timber superstructure. The work was commenced in 1871, and completed, except as to superstructure, in 1880.

The amount expended to June 30, 1890, was $368,453.66 and resulted in the construction of 1,155 linear feet of pier 21 feet in width, and 546 linear feet 42 feet in width, or a total length of 1,701 feet. The depth of water at the outer end of the pierhead was about 21 feet at mean low water.

During the fiscal year ending June 30, 1891, $7,033 was expended in replacing about 200 linear feet of the pier destroyed by the collisions of wrecked vessels in 1889, and in placing fender piles along 1,200 linear feet of the shore arm of the pier.

During the fiscal year ending June 30, 1895, there were no expenditures on account of this work.

The right to use this pier for railway purposes, granted in the act of July 15, 1870, has never been exercised, and doubtless never will be, as the pier has not sufficient strength to support the weight of modern freight engines. It is therefore impossible to obtain any assistance from the railroad company in maintaining and repairing the structure.

During the past three winters the cluster and fender piles at the head of the pier were completely carried away. As the use of the pier is necessary for work in progress at the Delaware Breakwater they will be replaced at the expense of the appropriation for that work.

The need of clear regulations governing the use of this pier and the neighboring anchorage under the shelter of the Delaware Breakwater becomes very apparent during seasons of ice and storms when the harbor is crowded with shipping. Legislation providing for the establishment of such regulations with penalties for their enforcement is recommended.

(See Appendix F 6.)

7. Delaware Breakwater, Delaware.—Under the act of Congress, May 7, 1822, $22,700 was appropriated for a survey of Delaware Bay near Cape Henlopen, for the purpose of determining upon the site for a harbor of shelter. In 1828 an appropriation of $250,000 was made for

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commencing the work under a plan submitted by a Board of Commissioners appointed by Congress.

The project of the Board contemplated the construction in the concavity of the bay just inside Cape Henlopen of two massive works in the pierres perdues or riprap system, separated by an interval or gap of 1,350 feet, the greater, called the breakwater, to afford safe anchorage during the gales from the north and east; the other, called the ice breaker, to protect shipping against northwesterly gales and the heavy drifting ice of the bay. This project was completed in 1869 under aggregate appropriations, including the first for survey, of $2,192,103.70. The stone used in the work amounted to 892,528 gross tons, and varied from one-quarter of a ton to 7 tons in weight, the smaller constituting the bulk of the mass, the larger used to cover the exterior slopes.

As completed in 1869 the breakwater is 2,558 feet long, and the ice breaker 1,359 feet long on top. The average width on top is 22 feet, and at base 160 feet. The top is from 12 to 14 feet above mean low water.

In 1882 a project was adopted for closing the gap between the breakwater and the ice breaker by means of a random stone foundation with a concrete superstructure. The random stone foundation was to be brought to a height of 12 feet below low water with a width on top of 48 feet; the concrete superstructure to have a width on bottom of 24 feet, rising to a height of 12 feet above mean low water, with a width on top of 12 feet. The estimated cost of this project was $675,000.

In 1883 and 1884 the project was modified by providing a foundation of brush mattresses for the random stone substructure and omitting the construction of a pile bridge across the gap, which formed part of the project of 1882 for closing the gap.

In 1890 the concrete superstructure was further modified by establishing its base at 15 feet below low water by making it rectangular in section, with a width of 27 feet and height of 27 feet, and by constructing the work to above the plane of high water of large concrete blocks, above which concrete in mass was to be used. The estimated cost of the modified project, including the $356,250 appropriated from 1882 to 1888, was $856,250.

In 1891 the random stone substructure having been practically completed to an average level of 15 feet below low water, the project for the hitherto proposed concrete superstructure was modified by substitution of random stone for the remaining part of the work, so as to raise the structure to a height of 14 feet above mean low water with a width on top of 20 feet, the width at low water to be 40 feet, and the slopes below this plane to be such as may be formed by the action of the sea; between low water and the top the slopes to be about 1 on 0.7, formed by heavy stones laid in position. The estimated cost of completing this part of the work is $220,000, or, including the $536,250 appropriated from 1882 to 1894, the cost of closing the gap is $756,250.

From the beginning of the work in 1822 to June 30, 1894, the total amount expended was $2,678,301.14, of which $486,197.44 was expended on the existing project for closing the gap and in office expenses, the substructure having been raised to the level of mean low water over the entire length of the gap, a distance of 1,350 feet.

During the fiscal year ending June 30, 1895, the sum of $1,096.40 was expended in leveling the upper surface of the substructure for a distance of 400 feet from the east end of the ice breaker.

Should funds be appropriated it is proposed to apply them to the continuation of the construction of the superstructure and the strengthening of the slopes if necessary.

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The increase in the dimensions of vessels since the present harbor was designed, in 1822, and the shoaling which has ensued behind the breakwater render the harbor in its present condition inadequate to the requirements of commerce. Upon the completion of the present project of closing the gap additional anchorage area will be added to the harbor, and it is hoped that the shoaling will cease and the anchorage be deepened.

July 1, 1894, balance unexpended		$52.56
Amount appropriated by act of August 17, 1894		50,000.00
		50,052.56
June 30, 1895, amount expended during fiscal year		1,096.40
July 1, 1895, balance unexpended		48,956.16
July 1, 1895, outstanding liabilities	$1,574.62	
July 1, 1895, amount covered by uncompleted contracts	40,738.38	
		42,313.00
July 1, 1895, balance available		6,643.16

Amount (estimated) required for completion of existing project..... 220,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897 100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix F 7.)

8. Rancocas River, New Jersey.—In its original condition Rancocas River carried a minimum low-water depth of 4½ feet between the mouth and Centerton, a distance of about 7½ miles, and from Centerton to Mount Holly, a distance of about 5½ miles, a ruling depth of about 2½ feet.

The original project of 1881 proposed the formation, by a dike at Coats Bar and dredging elsewhere, of a channel from 150 to 200 feet wide and 6 feet deep at mean low water from the mouth to Centerton, and thence to Mount Holly a channel 5 feet deep.

Operations under this project were carried on from 1881 to 1893. At the close of the fiscal year ending June 30, 1894, $34,860.32 had been expended in the formation of a low-water channel 100 feet wide and 6 feet deep from the mouth to Centerton, 50 feet wide and 5 feet deep for a distance of about three-fourths of a mile above Centerton, and thence to Mount Holly 25 feet wide and 4 feet deep, in the removal of three wrecks, and in office expenses.

During the past fiscal year the sum of $2,639.89 was expended in the formation of a channel 50 feet wide and 5 feet deep for a distance of about 2,100 feet, in continuation of the channel previously dredged, and in office expenses. The head of the dredged channel is now about 1¾ miles above Centerton and about 3¼ miles below Mount Holly; thence to Mount Holly there is a channel 25 feet wide and 4 feet deep.

July 1, 1894, balance unexpended	$39.59
Amount appropriated by act of August 17, 1894	3,000.00
	3,039.59
June 30, 1895, amount expended during fiscal year	2,639.89
July 1, 1895, balance unexpended	399.70

Amount (estimated) required for completion of existing project..... 43,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.

(See Appendix F 8.)

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9. Alloway Creek, New Jersey.—In its original condition Alloway Creek was obstructed between its mouth and Quinton, a distance of about 10 miles, by shoal areas in the upper half of the stream which reduced the low-water depths to from 1.3 to 4 feet.

The original project of 1889 proposed the formation by dredging of a channel 6 feet deep at mean low water and 60 feet wide from Quinton to a point about 1,000 feet above the Upper Hancock bridge; thence a channel of the same depth and 75 feet wide to a locality known as the Square, where the work is to be supplemented by a dike. At a locality known as the Canal, in addition to a channel of the last-named dimensions, the width of the stream was to be increased to about 150 feet between its low-water lines.

Up to the close of the fiscal year ending June 30, 1894, $8,929.12 had been expended in dredging at and near the Canal, the Square, and the Upper Hancock bridge, and in office expenses. Channels from 40 to 75 feet wide and 6 feet deep at mean low water were formed through the worst bars.

During the past fiscal year the sum of $272.18 was expended in office expenses and cost of inspection of the construction of the timber work of the dike at the Square.

July 1, 1894, balance unexpended	$70.88
Amount appropriated by act of August 17, 1894	3,000.00
	3,070.88
June 30, 1895, amount expended during fiscal year	272.18
July 1, 1895, balance unexpended	2,798.70
July 1, 1895, amount covered by uncompleted contracts	2,561.00
July 1, 1895, balance available	237.70
Amount (estimated) required for completion of existing project	13,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	3,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix F 9.)

10. Salem River, New Jersey.—In 1872 the upper part of this river was separated from the lower part by a dam and connected with the Delaware River by a canal. Thus two independent streams were formed.

In its original condition the channel of the Upper Salem River carried about 3 feet at mean low water over the bar, from 5 to 11 feet through the canal, and about 3 feet to Hoxie's bridge.

The original project for its improvement was adopted in 1881. It provided for the removal of a shoal near Biddles Landing at an estimated cost of $4,500. The work done in 1881 and 1882 resulted in the formation of a channel 60 feet wide and from 6 to 7 feet deep at mean low water from the head of the canal to a point about 200 feet above Biddles Landing, leaving about 700 feet to be improved. On account of shoaling it was then estimated that the completion of the improvement would cost from $4,000 to $6,000.

During the fiscal year ending June 30, 1894, the sum of $2,349.80 was expended in the formation, by dredging, of a low-water channel 6 feet deep and 50 feet wide from deep water at the head of the canal for a distance of 1,100 feet toward Hoxies Landing, and in office expenses.

The amount expended upon this project to June 30, 1894, is $5,462.73.

During the past fiscal year the sum of $1,746.61 was expended in completing the improvement by dredging a channel 50 feet wide and 6 feet deep at mean low water in continuation of the channel previously dredged, and in office expenses.

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July 1, 1894, balance unexpended	$46.61
Amount appropriated by act of August 17, 1894	1,700.00
	1,746.61
June 30, 1895, amount expended during fiscal year	1,746.61

(See Appendix F 10.)

11. Goshen Creek, New Jersey.—In its original condition Goshen Creek carried a low-water depth of from 2 to 4 feet, with a least low-water width of 20 feet and a high-water width of 36 feet, from Goshen to a point about 4,000 feet below; and thence to the mouth, a distance of about 2,500 feet, a low-water depth of from 3 to 5 feet with a least width of 30 feet.

The project for its improvement, adopted in 1891, proposed the deepening and widening by dredging of the 4,000 feet of the creek below Goshen Landing to a low-water depth of 3 feet and a width of 30 feet; the formation of a dredged channel 3 feet deep and about 50 feet wide through the bar at the mouth to the limit of the sand beyond the low-water line and the protection of the channel by a sheet-pile jetty.

The improvement was commenced during the fiscal year ending June 30, 1893, and to the close of that year the sum of $2,770.16 was expended in widening and deepening the channel to the proposed dimensions over a distance of about 3,975 feet below Goshen Landing. By this work about one-fourth of the projected improvement had been completed and the navigable conditions had been proportionately improved.

During the past two fiscal years no work has been done and the expenditures have been confined to office expenses.

That part of the improvement between Goshen Landing and the mouth of the creek has been practically completed.

The funds available are not sufficient to accomplish this work. They have therefore been withheld until a further appropriation is made by Congress.

The total amount expended to the close of the fiscal year ending June 30, 1894, was $2,976.86.

The sum of $23.14 was expended during the past fiscal year for office expenses.

July 1, 1894, balance unexpended	$23.14
Amount appropriated by act of August 17, 1894	3,000.00
	3,023.14
June 30, 1895, amount expended during fiscal year	23.14
July 1, 1895, balance unexpended	3,000.00
Amount (estimated) required for completion of existing project	6,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	3,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix F 11.)

12. Frankford Creek, Pennsylvania.—The river and harbor act of August 17, 1894, appropriated $2,000 for improving this creek by straightening the same between the crossings of Tulip and Roxborough streets in the county of Philadelphia. The objects of the improvement are to divert the stream from the existing channel so as to render unnecessary the construction of two bridges to carry the western approach to the bridge now being constructed by the Pennsylvania and New Jersey Railroad Company over the Delaware River at Philadelphia, and incidentally to facilitate the extension and improvement of streets in the city of Philadelphia.

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The execution of this work by the Pennsylvania Railroad Company at its own expense, and without cost to the United States, having been authorized by the Secretary of War, the sum appropriated has been withheld from expenditure awaiting the further action of Congress.

The proposed new channel has been partially completed from the crossing of Roxborough street north to the Kensington and Tacony Railroad.

Amount appropriated by act of August 17, 1894	$2,000 00
July 1, 1895, balance unexpended	2,000.00

(See Appendix F 12.)

13. Removing sunken vessels or craft obstructing or endangering navigation.—During the past fiscal year the following wrecks were removed under the provisions of the act of June 14, 1880: The schooner *Mount Vernon* from Maurice River Cove, Delaware Bay, and a part of an unknown car float from Manasquan Inlet, New Jersey. The amount expended in removal of wrecks during the past fiscal year was $971.03.

(See Appendix F 13.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations and surveys of the following localities, required by the act of August 17, 1894, were made by the local engineer, Maj. C. W. Raymond, Corps of Engineers, and reports thereon submitted through the Division Engineer, Col. H. L. Abbot, Corps of Engineers:

1. Preliminary examination of Delaware River between Trenton and Burlington, N. J., for improvement of river and protection of banks.—Major Raymond submitted report of examination December 27, 1894. It is his opinion, concurred in by the division engineer and by this office, that the river is worthy of improvement by the General Government from Burlington to Whitehill, and not worthy of improvement from Whitehill to Trenton. It is estimated that the survey necessary for preparation of plan of improvement, with estimates, will cost $1,000. The report was transmitted to Congress and printed in House Ex. Doc. No. 151, Fifty-third Congress, third session. (See also Appendix F 14.)

2. Preliminary examination of Rancocas River, New Jersey.—Major Raymond submitted report of examination November 15, 1894. This river is now under improvement by the General Government. Major Raymond reports project under which work is being done with funds provided by Congress, and states that under existing conditions the establishment and maintenance of increased channel depths will, in his opinion, cost more than is justified by the commercial benefits which would probably result from the improvement. For the reasons stated, it is his opinion and that of the division engineer, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 76, Fifty-third Congress, third session. (See also Appendix F 15.)

3. Preliminary examination of the Lumberton Branch of the Rancocas River, New Jersey, as far as Lumberton.—Major Raymond submitted report of examination November 17, 1894. He is of opinion, concurred in by the division engineer and by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 36, Fifty-third Congress, third session. (See also Appendix F 16.)

4. Preliminary examination of Mantua Creek, New Jersey.—Major Raymond submitted report of examination October 30, 1894. In his

opinion the locality is worthy of improvement by the General Government, and this opinion is concurred in by the division engineer and by this office. A survey for preparation of a project for improvement is estimated to cost $400. The report was transmitted to Congress and printed in House Ex. Doc. No. 66, Fifty-third Congress, third session. (See also Appendix F 17.)

5. Preliminary examination of Salem River from the mouth of said river as far as Salem City, N. J.—Major Raymond submitted report of examination November 14, 1894. He is of opinion that the river is worthy of improvement by the General Government, and this opinion is concurred in by the division engineer and by this office. The cost of the necessary survey is estimated at $500. The report was transmitted to Congress and printed in House Ex. Doc. No. 34, Fifty-third Congress, third session. (See also Appendix F 18.)

6. Preliminary examination of inside of Absecon Inlet, with a view to uniting the main channel along Brigantine Beach with the water bed along Rum Point and with the waters of Absecon Channel.—Major Raymond submitted report of examination October 24, 1894. It is his opinion, concurred in by the division engineer and by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 79, Fifty-third Congress, third session. (See also Appendix F 19.)

7. Preliminary examination of Buckshutem Creek, New Jersey.—Major Raymond submitted report of examination November 7, 1894. It is his opinion, concurred in by the division engineer and by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 42, Fifty-third Congress, third session. (See also Appendix F 20.)

8. Preliminary examination of Cold Spring Inlet, New Jersey.—Major Raymond submitted report of examination November 7, 1894. In his opinion, concurred in by the division engineer and by this office, the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 33, Fifty-third Congress, third session. (See also Appendix F 21.)

9. Preliminary examination of Susquehanna River, Pennsylvania, between Nanticoke and Pittston.—Major Raymond submitted report of examination October 23, 1894. In his opinion, concurred in by the division engineer and by this office, the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 29, Fifty-third Congress, third session. (See also Appendix F 22.)

10. Survey of Cooper Creek, New Jersey.—Major Raymond submitted report of survey January 2, 1895. The plan of improvement proposed by him contemplates the dredging of a channel 70 feet wide at bottom and 18 feet deep at mean high water from the mouth of the creek to Browning's Chemical Works, and a channel of the same dimensions through the bar just outside the mouth, in all, a distance of about 9,000 feet. at a total estimated cost of $35,000. The report was transmitted to Congress and printed in House Ex. Doc. No. 176, Fifty-third Congress, third session. (See also Appendix F 23.)

11. Survey of Dennis Creek, New Jersey.—Major Raymond submitted report of survey January 3, 1895. The plan submitted by him proposes the formation, by dredging, of a channel 60 feet wide and 8 feet deep at mean high water from the Dennisville Bridge downstream for a distance of about 8,450 feet, and the widening of the channel at the bends, at a total estimated cost of $10,000. The report was transmitted to

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Congress and printed in House Ex. Doc. No. 191, Fifty-third Congress, third session. (See also Appendix F 24.)

IMPROVEMENT OF RIVERS AND HARBORS IN DELAWARE, AND IN MARYLAND AND VIRGINIA EAST OF CHESAPEAKE BAY.

This district was in the charge of William F. Smith, United States agent, major of engineers, United States Army, retired; Division Engineers, Col. William P. Craighill, Corps of Engineers, to May 18, 1895, and Lieut. Col. Peter C. Hains, Corps of Engineers, since that date.

1. Wilmington Harbor, Delaware.—Previous to 1836, when the first appropriation for the improvement of the Christiana River was made, the depth of water at the entrance was about 8½ feet. The minimum depth in the channel of the portion of the river below Third street bridge was 8 feet. This depth was increased by dredging in that year to 10 feet. Under a project commenced in 1871 and completed in 1881 a 12-foot channel from 100 to 200 feet wide was made from the mouth to above the city of Wilmington. The present project was adopted in 1881 and is for a 15-foot low-water channel from the mouth of the river to the pulp works, with a width of 150 feet from the mouth to the Rolling Mill wharf, 100 feet to the Delaware and Western Railroad bridge, and 75 feet to the pulp works. The project included further a channel 12 feet deep and 50 feet wide from the latter works to the Delaware Railroad bridge, and construction of a jetty on the north side of the mouth of the river. Dredging operations and the construction of the jetty were begun in the following year. The original estimate was $175,551, which was increased in 1883 to $191,384 by changing the width of the proposed channel to 150 feet throughout. In 1884 the project was amended by raising the height of the jetty 4 feet. An extension of 322 feet to the jetty as then built was also proposed and approved, but has not yet been carried out.

Up to the close of the fiscal year ending June 30, 1894, the sum of $240,556.75 had been expended under this project. There was then an improved channel 15 feet deep at mean low water and 150 feet wide from the 15-foot depth outside the bar at the mouth to a point 2,515 feet above the Market street bridge, and above that point the channel for a distance of 820 feet was 80 feet wide, and a farther distance of 960 feet only 40 feet wide. This last cut reaches to the upper terminus of the present river improvements, and what remains to be done to complete them under the present project is to widen it and the preceding narrow section to the full width of 150 feet and to build the extension of the jetty. No work was done on the improvement during the fiscal year 1895.

The river and harbor act of August 17, 1894, appropriated $25,000 for continuing this improvement, including a survey of the Christiana River and Harbor with a view of obtaining a depth of 21 feet. The field work of this survey has been completed, and report with plans and estimates will soon be submitted.

July 1, 1894, balance unexpended	$3,193.25
Amount appropriated by act of August 17, 1894	25,000.00
	28,193.25
June 30, 1895, amount expended during fiscal year	7,671.85
July 1, 1895, balance unexpended	20,521.40

Amount (estimated) required for completion of existing project	22,634.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	20,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix G 1.)

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2. Ice harbor at New Castle, Del.—This harbor is one of the oldest on the Delaware River, constructed for the protection of vessels against floating ice, its origin dating back to colonial times. For many years it was the northern terminus of the New Castle and Frenchtown Railroad, one of the oldest in the country, from which transfers were made upon boats sailing to and from Philadelphia and farther north. Since the beginning of the present century its improvement and enlargement have been carried on by the United States Government at different periods, and up to the close of the fiscal year ending June 30, 1894, $238,655.29 had been expended.

The present project, which was adopted in 1884, provided for the repair of Pier M, the placing of riprap around it and Pier N, and the rebuilding of Pier H, also the increase of the area and depth of the harbor by dredging, the amount appropriated therefor being $22,600. The project so far as relates to the ice piers was completed in 1891.

During the fiscal year of 1894 the available balance of the appropriation of September 19, 1890, was expended in dredging the shoaler portion of the harbor to a depth of 18 feet below mean low water from the 18-foot contour to within 10 feet of the wharf line. The harbor space for deep-draft vessels was thus materially increased. This completes the project.

The harbor in its present condition affords the best shelter in winter to vessels proceeding up or down the Delaware when the ice is running. It has, however, on many occasions proved inadequate to protect all those that sought refuge in exceptionally severe weather, and in consequence those moored near the outer ice piers were much exposed. An additional ice pier farther out in the river would give better protection, and as the ice piers, especially the older ones, are liable to be damaged by ice or by collision with vessels and may need immediate repairs, a small sum should be available to keep them in proper condition.

July 1, 1894, balance unexpended	$128.65
June 30, 1895, amount expended during fiscal year	50.00
July 1, 1895, balance unexpended	78.65

(See Appendix G 2.)

3. Appoquinimink River, Delaware.—This stream is a tidal tributary of Delaware Bay, flowing through Newcastle County, Del. It is navigable for about 10 miles for vessels of light draft. A bar, having only 1½ feet of water over it at low tide, obstructs the mouth of the river seriously during that stage of the tide. The average rise and fall of the tide is 6 feet at the mouth and 3.2 feet at Odessa, the head of navigation.

The project for improvement proposed in a report on a survey of the river made in 1889 and adopted under an appropriation made by the river and harbor act approved September 19, 1890, provides for dredging a channel 8 feet deep at mean low water with a width of 100 feet from the mouth to New Bridge, near Townsend's wharf, and thence 80 feet wide to the county bridge at Odessa, a total distance of 5 miles, the estimated cost of the improvement being $39,963. At the close of the fiscal year ending June 30, 1894, the sum of $10,000 had been expended and the river had been dredged, in a down-river direction, from Watkin's wharf to a point 6,762 feet below Odessa bridge, resulting in a greatly increased harbor space at the town of Odessa and a marked improvement of the channel, which gave great relief to shipping. The actual distance dredged is 6,462 feet, of which 2,570 feet is 80 feet wide and 3,892 feet is 50 feet wide.

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The river and harbor act of August 17, 1894, having appropriated $5,000 for continuing the improvement, a contract has been made for dredging, and work thereon will be commenced soon.

Amount appropriated by act of August 17, 1894	$5,000.00
June 30, 1895, amount expended during fiscal year	6.90
July 1, 1895, balance unexpended	4,993.10
Amount (estimated) required for completion of existing project	24,963.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	2,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix G 3.)

4. Smyrna River, Delaware.—This river, formerly called Duck Creek, had, before improvements began in 1879, a minimum depth of 2½ feet within the river and about 4 feet over the bar at the mouth. Navigation was possible only at high tide, and was carried on by one steamer and seven small schooners.

In 1878 a project was made for the improvement of the whole river, including a plan for deepening the channel across the bar at the mouth. By special direction of Congress the improvement of the bar was commenced first, and during the following four years three appropriations, aggregating $10,000, were expended in dredging a channel across this obstruction 100 feet wide and 8 feet deep at mean low water. The dredged channel soon filled up again.

A new project was submitted in 1887 for a 7-foot low-water channel 60 feet wide inside the river and 100 feet at the bar, the channel at the latter point to be protected on each side by stone jetties. The estimated cost of this project is $90,698.40. The portion of the project relating to dredging has been adopted, the estimated cost thereof being $37,365.20.

Up to the close of the fiscal year ending June 30, 1894, the sum of $17,805.91 had been expended. Four thousand seven hundred and thirty feet of the channel was completed in accordance with the project, the total length to be improved being 25,425 feet. The entire length was dredged during previous seasons, but not to the full dimensions. Twenty thousand six hundred and ninety-five feet of the channel, now 40 feet wide and 6½ feet deep, remains to be widened and deepened to the approved dimensions. No examination of the channel has recently been made, but it is believed to be in fair condition.

The channel made has been of great benefit to navigation and has facilitated expeditious and regular transportation which before was impossible.

The river and harbor act of August 17, 1894, appropriated $5,000 for continuing this improvement. Proposals for dredging were opened April 29, 1895, the lowest bidder being Fred. L. Somers, of Philadelphia, Pa., at 12.7 cents per cubic yard, place measurement, and contract has been made with him for this and other improvements in Delaware, the entire work to be completed by September 1, 1896.

July 1, 1894, balance unexpended	$194.09
Amount appropriated by act of August 17, 1894	5,000.00
	5,194.09
June 30, 1895, amount expended during fiscal year	171.90
July 1, 1895, balance unexpended	5,022.19
July 1, 1895, amount covered by uncompleted contracts	5,000.00
July 1, 1895, balance available	22.19

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Amount (estimated) required for completion of existing project.....	$14,365.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix G 4.)

5. *Murderkill River, Delaware.*—This river is a tidal stream and a tributary of Delaware Bay, and flows through Kent County, Del. Its navigable portion is about 9 miles long. The condition of the river is fair for the greater part of its length, the average width and depth being 90 and 6 feet, respectively. Outside the junction with Delaware Bay, however, exists a serious obstruction—the flats, which are nearly bare at low tide and extend for nearly a mile from the shore. The average rise and fall of the tide at the mouth is 3.83 feet.

In 1881 an examination of this river was made by the United States Engineer Department in accordance with the river and harbor act of March 3, 1881, and a project submitted for its improvement. No appropriation was made by Congress, however, as the river was at that time in the hands of an improvement and navigation company chartered by the State. This company had expended about $10,000 in rectifying the many bends of the river by cutting straight canals and in dredging a narrow cut across the flats at the mouth. The latter slowly filled up again.

The present project for improvement is based upon a survey of the river made in 1891, and is for a 7-foot low-water channel 80 feet wide from the town of Frederica, at the head of navigation to the mouth of the river, and 150 feet wide from the mouth across the flats outside to the 7-foot depth in Delaware Bay, the cut at the mouth to be protected by forming an embankment of the dredged material on each side, the estimated cost being $47,550. The project was adopted in 1892, an appropriation of $7,000 having been made by Congress under which the first work as stated below was done during the fiscal years ending June 30, 1893, and June 30, 1894. Up to the close of the fiscal year ending June 30, 1894, $6,976.22 had been expended, and a channel dug to a depth of 5 feet below mean low water across the flats from a point a short distance inside the mouth of the river to the 5-foot depth in Delaware Bay, its width being 60 feet and its length 4,840 feet.

The river and harbor act of August 17, 1894, appropriated $6,500 for continuing the improvement, and declared that $1,500 of it may, in the discretion of the Secretary of War, be used in removing the bar and obstructions at the mouth of St. Jones River. A project for the expenditure of the appropriation, which was duly approved, contemplates the dredging of a cut 40 feet wide and 7 feet deep at mean low water at the shoals and bars in the Murderkill River which form the most serious obstructions to navigation, including a cut-off at Lower Landing, about 4 miles above the mouth, and the dredging of a cut 60 feet wide and 6 feet deep at mean low water across the bar and obstructions at the mouth of the St. Jones River.

Proposals were opened April 29, 1895, and contract made with the lowest bidder at 12.7 cents per cubic yard, measured in place.

Dredging operations were commenced on May 29, 1895, at Lower Landing with a grapple dredge, and on June 13 an additional dredge—a dipper dredge—was put on the work. At the close of the fiscal year 21,411 yards of material, principally mud, had been dredged, the cut-off completed, and several shoals removed.

It is expected that the work to be done by the contractor on this river and the mouth of St. Jones River will be completed in about a month.

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July 1, 1894, balance unexpended		$23.78
Amount appropriated by act of August 17, 1894		*6,500.00
		6,523.78
June 30, 1895, amount expended during fiscal year		470.43
July 1, 1895, balance unexpended		6,053.35
July 1, 1895, outstanding liabilities	$2,631.00	
July 1, 1895, amount covered by uncompleted contracts	3,422.35	
		6,053.35

Amount (estimated) required for completion of existing project	35,550.00
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	6,500.00

(See Appendix G 5.)

6. Mispillion River, Delaware.—This river is a tributary of Delaware Bay and enters the latter about 17 miles northwest of Cape Henlopen. It is navigable for about 12 miles, as far as Milford, a thriving town with shipyards and numerous factories. The mouth of the river is greatly obstructed by a flat foreshore without a channel. Vessels can only enter and depart at high water, which rises on an average 4 feet.

The river from Milford to the mouth was improved by the General Government between the years 1879 and 1889, and $17,000 expended in making a channel 40 feet wide and 6 feet deep at mean low water.

The project for improvements at the mouth of the river, proposed in a report on a survey made in 1891, provides for a cut across the flats in a southeasterly direction, having a width of 150 feet and a depth of 6 feet at mean low water, beginning opposite the light-house and ending in deep water in the bay; the cut to be protected on the upper or north side by a bank made of excavated material. The estimated cost is $24,000.

Up to the close of the fiscal year ending June 30, 1894, $10,506.09 had been expended on the project. A pile dike about 500 feet long had been built from high-water mark in the direction of the future channel, and a channel about 570 feet long, 80 feet wide and 5 feet deep at mean low water made from the 5-foot depth in the Mispillion River to a point opposite and 50 feet west from the outer end of the dike.

The river and harbor act of August 17, 1894, appropriated $10,000 for continuing the improvement.

Experience in the expenditure of the appropriation of 1892 had shown, first, that it would be useless to excavate a channel not covered by a good dike of piling, the cost of which would be far in excess of the original estimate for this improvement, which was but $24,000; and second, that as the water flowing from the Mispillion needs a more contracted channel above the light-house, a deflecting dike about 350 feet in length should be built on the south side of the channel from high water near the light-house.

It was therefore recommended to the Chief of Engineers, and approved by him, that the dike—a crib dike—be built and that dredging be carried on to the contemplated depth only to the end of the dike built on the north side of the channel in 1893. The cost was estimated to be $4,600. The remainder of the appropriation was recommended to be retained until Congress should see proper to appropriate the sum

* Of this amount $1,500 may be used in removing shoal at the mouth of St. Jones River.

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necessary to complete a dike and excavation to the 6-foot depth at mean low water in the Delaware Bay, the estimated cost of which is $50,700.

The work to be done at the present time is intended to give the current the necessary direction as it leaves the mouth, and that the resultants of the action of the ebb currents of the Delaware and Mispillion rivers and the ebb from Cedar Creek may keep open and, doubtless, improve the present channel of this bay, which now skirts along the shore to near the Roberts House on Cedar Beach, a distance of 4,000 feet, and thence out to deep water in the bay.

On account of the distance across the obstructing mud flats the proposed improvements can not even be partially made available for navigation until they are nearly or entirely completed.

Contract for the dredging has been made, after the usual advertising, at 12.7 cents per cubic yard, measured in place, and will probably be done early in the coming fiscal year. Proposals for the crib dike are to be opened July 1, 1895.

July 1, 1894, balance unexpended	$1,493.91
Amount appropriated by act of August 17, 1894	10,000.00
	11,493.91
June 30, 1895, amount expended during fiscal year	1,164.11
July 1, 1895, balance unexpended	10,329.80
July 1, 1895, amount covered by uncompleted contracts	1,600.00
July 1, 1895, balance available	8,729.80

(See Appendix G 6.)

7. *Broadkiln River, Delaware.*—In its original condition the depth of water in the river was from 3 to 4 feet at the numerous shoals which impeded navigation. The depth at the entrance was and still is from 1½ to 2 feet at low water.

The original project for improvement was made in 1871, and is for a 6-foot low-water navigation, with a minimum width of 40 feet from the mouth of the river to Milton, the head of navigation, and for a new entrance, protected by a jetty, at an estimated cost of $80,447. This project was modified in 1881 relative to the entrance, and the estimate reduced to $51,450. The channel within the river has been completed in accordance with the project at an expense of $35,000, which was the total amount expended at the close of the fiscal year ending June 30, 1894. After entering, vessels are no longer detained by the shoals at low tide and proceed directly to their destination.

The amount required for the completion of the project is for the improvements at the mouth of the river, as designed in 1871 and modified in 1881. In view, however, of the projected location (only a few miles below the Broadkiln River) of the outlet for the inland waterway from Chincoteague Bay to Delaware Bay, a question has arisen whether the Broadkiln River can not be connected with the waterway at much less cost and with greater advantage to both. It is therefore not considered advisable to continue work on the project at present.

Amount (estimated) required for completion of existing project $21,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.

(See Appendix G 7.)

8. *Inland waterway from Chincoteague Bay, Virginia, to Delaware Bay, at or near Lewes, Del.*—This improvement is made with a view to

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forming an inland navigation route about 75 miles in length, beginning in Chincoteague Bay and following generally deep water in Sinepuxent, Isle of Wight, and Big and Little Assawaman bays; thence across the country for about 4 miles from Little Assawaman Bay to Indian River bay; thence across the latter into and up Rehoboth Bay; thence from the head of Rehoboth Bay, for about 8 miles, across Lewes and Reho-Both Hundred into Delaware Bay, at the Delaware Breakwater Harbor. The project adopted in 1886 contemplated a dead level tidal canal 70 feet wide at bottom, the depth to be made to 6 feet below the mean low-water level in the Delaware Breakwater Harbor, at an estimated cost of $350,000. This project was modified in 1892 so far as it relates to the section of the waterway situated between Rehoboth Bay and Delaware bays by reducing the width at the bottom to 20 feet.

Up to the close of the fiscal year ending June 30, 1894, $118,380.44 had been expended. Little Assawaman and Indian River bays had been connected by a cut 20 feet wide and 4 feet deep, over which three temporary wooden bridges, provided with draws, were constructed, and 2,300 feet of the cut to be made between Rehoboth and Delaware Bay had been completed.

From July 1, 1894, when work was in progress under contract dated July 31, 1893, to January 21, 1895, when this and the supplementary contract were closed, 63,363 cubic yards of material was removed, and a cut 9 feet deep, 20 feet wide, and 6,700 feet long made, connecting the cut excavated by steam shovels previous to July 1, 1893, and making a waterway 9,000 feet long and 6 feet deep below the level of mean low water of the Delaware Breakwater Harbor. Also a cut to the depth of mean low water only, 1,225 feet long, extending from the end of the cut just named to the Delaware, Maryland and Virginia Railroad crossing.

The river and harbor act of August 17, 1894, appropriated $25,000 for continuing the improvement, to be used from Delaware Bay to Indian River. On November 8, 1894, the Chief of Engineers approved a project for the expenditure of this appropriation in continuing the main project between Indian River and Delaware Bay, and for the expenditure of any balance from previous appropriations in dredging along the route between Assawaman and Delaware bays. Proposals were opened January 8, 1895, and contract made with the lowest bidder at 23½ cents per cubic yard, measured in place, the work contracted for to be completed by October 1, 1895.

Under this contract the contractors were called upon to commence excavation at the end of the cut on the south side of the Delaware, Maryland and Virginia Railroad crossing, to which point work had been carried under the preceding contract, and to continue northward along the line laid out for the waterway across the roadbed of that railroad; but an injunction was immediately served upon them and the United States agent in charge, at the instance of that company, restraining them and all others from interfering with their tracks, etc., upon the alleged ground that the United States has not acquired title to the right of way for the waterway across the land used for the railroad tracks. By authority of the Chief of Engineers work was therefore begun on February 4, 1895, at a point 900 feet north of the railroad crossing referred to. A cut was made for a distance of 800 feet to an average depth of 14 feet below the surface of the ground, with sides of cut sloped, and 45,681.5 cubic yards of material has been removed, making a total of 109,044 cubic yards removed on the waterway during the fiscal year ending June 30, 1895.

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July 1, 1894, balance unexpended		$25,369.56
Amount appropriated by act of August 17, 1894		25,000.00
		50,369.56
June 30, 1895, amount expended during fiscal year		31,962.52
July 1, 1895, balance unexpended		18,407.04
July 1, 1895, outstanding liabilities	$2,500.00	
July 1, 1895, amount covered by uncompleted contracts	15,800.00	
		18,300.00
July 1, 1895, balance available		107.04

Amount (estimated) required for completion of existing project	181,250.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix G 8.)

9. Susquehanna River above and below Havre de Grace, Md.—Before improvements were begun in this section of the river the least depth of water over the shoals between Havre de Grace and Spesutia Island was 5 feet at low water. The channel above Havre de Grace between Watson Island and the shoal running out from the west shore was narrow, and believed to be one of the causes of ice gorges at and near Port Deposit.

Improvements have been in progress since 1852. The present general project is for a 15-foot low-water channel below Havre de Grace and for the removal of the shoal opposite Watson Island to a depth of 8 feet below mean low water. Estimated cost, $168,000.

The channel below Havre de Grace was dredged the last time in 1885. It has shoaled again. The channel at Watson Island has been widened about 400 feet, but the shoal which was removed has nearly entirely reformed since the discontinuance of work in 1889.

Up to the close of the fiscal year ending June 30, 1894, $158,851.63 had been expended on this section of the river, including $49,729.15 for work for the Fish Commission.

There were no operations during the fiscal year ending June 30, 1895, the small amount available being limited to expenditure above the Philadelphia, Wilmington and Baltimore Railroad bridge, and regarded insufficient to bring about results permanent enough to justify its expenditure.

The river and harbor act of August 17, 1894, appropriated for maintenance $4,000, to be expended above Havre de Grace, including survey from a point 1 mile below the town of Havre de Grace, to a point 1 mile above Port Deposit, to ascertain what is necessary to prevent the accumulation of ice and ice gorges in said river and the cost thereof. This survey has been made, and a report thereon with a plan and an estimate is submitted herewith in Appendix G 31.

July 1, 1894, balance unexpended	$8,038.37
Amount appropriated by act of August 17, 1894	4,000.00
	12,038.37
June 30, 1895, amount expended during fiscal year	2,215.74
July 1, 1895, balance unexpended	9,822.63

Amount (estimated) required for annual dredging	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

(See Appendix G 9.)

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10. Elk River, Maryland.—This river is a tributary of Chesapeake Bay, and is navigable for 17 miles, as far as the town of Elkton, in Cecil County, where the average rise of the tide is 2½ feet. Before improvements were begun in 1873 the least depth in the channel was 1¼ feet.

In 1884 a project giving a channel 80 feet wide over the bar at Cedar Point, 3 miles below Elkton, and 70 feet wide from Cedar Point to the county bridge in the town, with a general depth of 7 feet at mean low water, was completed at an expense of $31,500. The channel near the bridge soon filled in again, reducing the depth to about 5 feet at low water.

The project for improvement adopted in 1890 provides for an 8-foot low-water channel 100 feet wide from the lower county bridge at Elkton to the clubhouse opposite Cedar Point, a distance of about 2 miles, at an estimated cost of $24,000. At the close of the fiscal year ending June 30, 1894, $14,996.63 had been expended and the channel completed as projected.

July 1, 1894, balance unexpended	$3.37
June 30, 1895, amount expended during fiscal year	3.37

(See Appendix G 10.)

11. Fairlee Creek, Maryland.—The original depth at the mouth before improvements were begun was 2 feet at low tide. Within the creek it was about 5 feet. Navigation was and still is carried on by a few flat-bottomed so-called lime boats and by one small schooner.

The existing project is for a 7-foot low-water channel 100 feet wide from deep water in Chesapeake Bay to a point about 3 miles above the mouth of the creek; also the conditional dredging of a turning basin at the upper end of the channel, the estimated cost being $15,558.

Up to the close of the fiscal year ending June 30, 1894, $10,000 had been expended, and the channel, as proposed, from deep water in the bay to the mouth, had been completed and a portion of the channel inside the creek had been dredged to the required depth for a distance of 4,738 feet and for a width of 50 feet.

No appropriation was made for this creek in the last river and harbor act, and there were consequently no operations during the past fiscal year. There are as yet no indications that the commerce of the creek is increasing.

Amount (estimated) required for completion of existing project	$5,558.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

(See Appendix G 11.)

12. Chester River, Maryland, from Crumpton to Jones Landing.—This river is a tidal stream 40 miles long, forming the boundary line between Kent and Queen Anne counties, eastern shore of Maryland, and flows into Chesapeake Bay. It is navigable for vessels drawing 6 feet of water at low tide as far as Crumpton, about 33 miles above the mouth. The least depth of water within the last 7 miles of the river is 3 feet. At Crumpton the average rise of the tide is 2.1 feet. A short distance from this town several shoals have previously been improved by the United States.

The existing project for improvement is for a 6-foot low-water channel 60 feet wide from Crumpton to Jones Landing, a distance of 6¼ miles, at an estimated cost of $12,750.

Up to the close of the fiscal year ending June 30, 1894, $7,991.67 had been expended, improving the channel for about 4¾ miles, and regular trips are now made by vessels trading in the river. The dredged chan-

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nel is in good condition; it does not as yet extend far enough, however, to have any marked influence upon the commerce of the river.

No work was done during the fiscal year 1895, the funds provided by the appropriation of 1892 having been used early in 1893. An appropriation of $1,500 for continuing this improvement was made by the river and harbor act of August 17, 1894, and contract for dredging has been made with the Baltimore Dredging Company for this and other improvements on the eastern shore of Chesapeake Bay, the work to be completed by December 20, 1895.

July 1, 1894, balance unexpended	$8.33
Amount appropriated by act of August 17, 1894	1,500.00
	1,508.33
June 30, 1895, amount expended during fiscal year	17.28
July 1, 1895, balance unexpended	1,491.05
July 1, 1895, amount covered by uncompleted contracts	1,491.05
Amount (estimated) required for completion of existing project	3,250.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	3,250.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix G 12.)

13. Choptank River, Maryland.—Before improvements were begun in 1879 the depth of water in the channel between Denton and Greensboro varied from 2 to 8 feet at low water. Navigation carried on by small sailing vessels extended only to 3 miles above Denton. Upon the remaining 5 miles, to Greensboro, all freight had to be transported upon scows.

A project for improvement was made in 1880 for an 8-foot low-water channel 75 feet wide, the estimated cost being $79,000. The project was adopted the same year. Since that time the channel has been dredged at various points to depths of 6, 7, and 8 feet, and for a width of 40 feet only. Up to the close of the fiscal year ending June 30, 1894, $48,000 had been expended in making a channel not less than 75 feet wide and 7½ feet deep between Greensboro and the Brick Mills, a distance of about 4 miles. The remaining 4 miles, to Denton, have been partly improved by dredging the channel, where needed, to a depth of 5 and 6 feet and widening it to about 40 feet. This section and several points in the upper river remain, therefore, to be dredged to the proposed width and depth, 75 feet and 8 feet, respectively. Shortly after the main obstructions had been removed, in 1887, steamboat navigation with Baltimore was established, and since that time commerce has steadily increased.

An appropriation of $2,000 for continuing this improvement was made by the river and harbor act of August 17, 1894, and contract for dredging has been made with the Baltimore Dredging Company for this and other improvements on the eastern shore of Chesapeake Bay, the work to be completed by December 20, 1895.

Amount appropriated by act of August 17, 1894	$2,000.00
June 30, 1895, amount expended during fiscal year	20.24
July 1, 1895, balance unexpended	1,979.76
July 1, 1895, amount covered by uncompleted contracts	1,979.76
Amount (estimated) required for completion of existing project	18,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	2,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix G 13.)

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14. La Trappe River, Maryland.—This river, formerly called Dividing Creek, is in Talbot County, Eastern Shore of Maryland, and flows into the Choptank River, one of the larger tributaries of Chesapeake Bay. It is about 3 miles long and has no fresh water inflow at the head, and was originally only 4 feet deep. The entrance to the river was seriously obstructed by several shoal bars, with a least depth of 9 feet in the narrow channel, which was very tortuous and about one-half of a mile long. The average rise of the tide is 1.55 feet.

Previous to the adoption of the present project the sum of $5,333.50, raised by private subscription, had been expended in dredging at the head of the river and at the bar at the mouth. The average depth in the river was thereby increased to 8 feet and the channel at the mouth was somewhat widened.

The present project for improvement, which was proposed in a report on a survey made in 1891, provides for a channel 150 feet wide and 11 feet deep across the bar at the mouth, and for a channel 75 feet wide and 8 feet deep at mean low water inside the river as far as Trappe Landing, situated at the head of navigation, and a turning basin at the latter point. The estimated cost is $7,250.

An appropriation of $2,500 was made for this work by the river and harbor act approved July 13, 1892.

Up to the close of the fiscal year ending June 30, 1894, $2,496.30 had been expended, and the channel across the mouth had been dredged to a width of 100 feet and a depth of 11 feet at mean low water. The channel is of great benefit to the steamers, which usually enter and leave the river during the nighttime.

The river and harbor act of August 17, 1894, having appropriated $4,750 for completing this improvement, proposals for dredging were advertised for and opened November 9, 1894. The lowest bid was 15 cents per cubic yard, scow measurement. This was accepted and contract made, the work to be completed by November 3, 1895. This work, it is expected, will complete the project.

July 1, 1894, balance unexpended	$3.70
Amount appropriated by act of August 17, 1894	4,750.00
	4,753.70
June 30, 1895, amount expended during fiscal year	47.58
July 1, 1895, balance unexpended	4,706.12
July 1, 1895, amount covered by uncompleted contracts	4,706.12

(See Appendix G 14.)

15. Warwick River, Maryland.—This river, formerly named Secretary Creek, is in Dorchester County, eastern shore of Maryland, and flows into the Choptank River, one of the large tributaries of Chesapeake Bay. It is a small tidal basin 2 miles long, with no fresh-water influx at the head, and was originally only 4 feet deep. The average rise of the tide is 1.7 feet.

Before the adoption of the present project about $12,000 had been expended in the improvement of this river, $6,000 by the General Government and the remaining amount by private parties.

The present project for improvement, which was proposed in a report on a survey made in 1891, provides for a channel 100 feet wide and 10 feet deep at mean low water from the 10-foot depth in Choptank River to Secretary Landing, at the head of the river, including a turning basin at the latter point, at an estimated cost of $18,600.

Up to the close of the fiscal year ending June 30, 1894, $5,991.23 had been expended on this project, and 4,400 feet of the channel as approved

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had been completed, beginning in the Choptank River, outside the mouth of the river, and part of the turning basin at Secretary Landing deepened to 10 feet. The obrtructions at the entrance, which formerly seriously impeded navigation during low tides and high northwesterly winds, are now removed, but the channel inside the river remains to be improved and the turning basin completed.

The sum of $2,000 having been appropriated by the river and harbor act of August 17, 1894, for continuing this improvement, proposals for dredging were advertised for and opened November 9, 1894. The lowest bid was 16 cents per cubic yard, scow measurement. As this price was regarded too high, the bids were rejected and the service advertised again. The second bids were for all the improvements on the eastern shore of Chesapeake Bay combined, and the lowest bid 19.8 cents per cubic yard, place measurement. There was but little difference between this price and the lowest offered for work on this river at the previous opening, but as the bids were combined with work to be done at other points along Chesapeake Bay, for several of which the price was considerably lower, it was considered to be to the interest of the Government to accept it, and contract has been made requiring dredging to be completed by December 20, 1895.

Dredging operations were commenced on June 25, 1895, at the turning basin, which was found to have shoaled, and by the end of the fiscal year 3,816 cubic yards of material had been removed under the contract and deposited in deep water in the Choptank River. It is expected that work to be done under the contract will be completed early in July, 1895.

July 1, 1894, balance unexpended		$8.77
Amount appropriated by act of August 17, 1894		2,000.00
		2,008.77
June 30, 1895, amount expended during fiscal year		26.32
July 1, 1895, balance unexpended		1,982.45
July 1, 1895, outstanding liabilities	$863.00	
July 1, 1895, amount covered by uncompleted contracts	1,119.45	
		1,982.45

Amount (estimated) required for completion of existing project	10,600.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	2,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix G 15.)

16. Cambridge Harbor, Maryland.—The entrance to this harbor had originally a depth of water of only 4½ feet at low tide. Within the harbor the depth averaged about 3 feet. During strong northwesterly winds vessels drawing over 3 feet of water could not cross the bar. The local commerce was carried on by a limited number of small sailing vessels and one steamer of light draft.

Previous to 1871 the citizens of Cambridge expended $7,500 in dredging the harbor. In that year the General Government began improvements under a project completed in 1879, resulting in a channel not less than 100 feet wide across the bar and 8 feet in depth, certain portions of the inner harbor being dredged to the same depth at the same time. The channel across the bar was increased in width somewhat in 1884 with the $2,500 appropriated in 1879. The amount expended under this project was $32,500.

The present project is based upon a survey in 1887 and was adopted in 1888. It provides for a channel 12 feet deep at mean low water,

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having a width of 150 feet from the 12-foot depth in the Choptank River to the railroad wharf, and for dredging the irregular area of the inner harbor below and above the bridge to a depth of 10 feet and 8 feet below mean low water, respectively, at an estimated cost of $17,736.60.

At the close of the fiscal year ending June 30, 1894, $10,875.06 had been expended, and the 12-foot channel from the Choptank River to the railroad wharf and the dredging in the inner harbor below the bridge to 10 feet had been completed.

The river and harbor act of July 13, 1892, provided that no money should be expended for work above the bridge until the draw in it shall have been widened sufficiently to accommodate the commerce of the river. The draw having been widened during the year 1895 in accordance with plans approved by the Secretary of War, proposals for the dredging required for the completion of the project were opened April 5, 1895, and contract made with the lowest bidder at 19.8 cents per cubic yard, place measurement.

Dredging was begun May 18 and the work completed June 22, 1895, 26,429 cubic yards of material having been removed.

The project for the improvement of this harbor is now completed. A channel 150 feet wide and not less than 12 feet deep at mean low water has been dredged from that depth in the Choptank River to the railroad wharf, a distance of nearly a mile. The inner harbor below the bridge has been dredged over its whole irregular area to a depth of 10 feet at mean low water, and the part of the harbor above the bridge, which is also very irregular in shape, has been improved by dredging it along its axis for a width of 215 feet and a length of 750 feet to a depth of 8 feet at mean low water. This is the condition of this harbor at the end of the fiscal year.

The improvements have been of great benefit to the great oyster fleet which makes this harbor the central point on the Choptank River for the oyster industries, and which annually increases in numbers, so that now on many days during the winter there is scarcely sufficient room for all to anchor. They have also had a marked influence upon the growth of the town of Cambridge, which has more than doubled since 1870.

The channel across the bar has a tendency to fill up from the littoral drift coming down the south shore of the Choptank River, and in consequence has been dredged several times since improvements commenced, and will undoubtedly need redredging in the near future unless protective works are constructed on the east side.

Nothing further seems to be required under this project.

July 1, 1894, balance unexpended	$6,861.94
June 30, 1895, amount expended during fiscal year	2,919.83
July 1, 1895, balance unexpended	3,942.11
July 1, 1895, outstanding liabilities	3,750.00
July 1, 1895, balance available	192.11

(See Appendix G 16.)

17. Broad Creek River, Delaware.—This river is a tidal stream and a tributary of the east fork of the Nanticoke River, which flows into the Chesapeake Bay. It is wholly in the western portion of Sussex County, Del., its navigable length being about 7 miles. Laurel, a growing manufacturing town, is at the head of navigation.

Broad Creek River, formerly named Broad Creek, has previously been improved by the General Government. Before improvements

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were commenced in 1881 the low-water depth at Laurel was 2 feet; below the town it was in some places only 1½ feet. At the close of the year 1889, when the original project was completed, a channel 6 feet deep at mean low water and 50 feet wide had been dredged from Bethel to Laurel, a distance of nearly 3 miles, and contributed toward making Laurel an important shipping point on the peninsula. The cost of these improvements was $35,000; but the rapidly increasing commerce on the river demanded an enlargement of the channel.

The project for improvement proposed in a report upon an examination made to comply with requirements of the river and harbor act approved September 19, 1890, provides for dredging a channel 70 feet wide and 8 feet deep at mean low water, from Bethel to the head of navigation at Laurel, at an estimated cost of $15,000.

Up to the close of the fiscal year ending June 30, 1894, $4,989.05 had been expended, and 6,455 feet of the channel as approved had been completed above Bethel, and an additional cut was made 8 feet deep, but only 40 feet wide, for a length of 215 feet, across a shoal situated just beyond the section of the channel that had been dredged to the full width, and navigation at several sharp turns in this section of the river was thereby much improved.

The river and harbor act of August 17, 1894, appropriated $5,000 for improving Broad Creek River, and directed that so much of it as may be necessary shall be used for removal of a bar that extends from the railroad bridge at Seaford toward the mouth of Nanticoke River. This work is now a part of the project for the improvement of Broad Creek River, and as the cost of removing the bar referred to will be more than the $5,000 appropriated, it was determined to use the whole appropriation as far as it would go in removing the bar by dredging the existing channel to a depth of 9 feet below mean low water and about 50 feet wide from Seaford to deep water below. Proposals for the required dredging were advertised for and opened April 5, 1895. The lowest bid was 19.8 cents per cubic yard, place measurement. Contract has been made with the Baltimore Dredging Company at this price for the work at this and other places on the eastern shore of Chesapeake Bay, the entire work to be completed by December 20, 1895.

July 1, 1894, balance unexpended	$10.95
Amount appropriated by act of August 17, 1894	*$5,000.00
	5,010.95
June 30, 1895, amount expended during fiscal year	10.80
July 1, 1895, balance unexpended	5,000.15
July 1, 1895, amount covered by uncompleted contracts	5,000.00
July 1, 1895, balance available	.15
Amount (estimated) required for completion of existing project	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	2,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix G 17.)

18. Wicomico River, Maryland.—The portion of the river at and just below Salisbury has been under improvement by the United States since 1872. At that time the navigable channel, with a minimum depth of 8 feet at low water, extended to a point within 2 miles of Salis-

*As much of this as may be necessary to be used for removal of bar in Nanticoke River.

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bury. The extreme upper portion as far as the mill dam in the heart of the town was quite shoal, and had an average depth of only 18 inches at low tide. Between 1872 and 1885 a channel 75 to nearly 100 feet wide and 7 feet deep at low water was dredged from deep water below to the drawbridge in the town, at a cost to the Government of about $49,000.

The present project, demanded by the remarkable increase in the shipping and dependent industries, is based upon a survey of the river made in 1889. It provides for a channel 9 feet deep at mean low water from that depth below to the drawbridge at Salisbury, the width to be from 100 to 150 feet, at an estimated cost of $23,200.

On June 30, 1894, $17,105.73 had been expended and the cut widened to the approved width of the channel from the dock of the Maryland Steamboat Company to Island Point, a distance of 3,930 feet, the least depth made being 9 feet. About one-half the length of the channel remains to be completed. The improvements made so far have increased the harbor room and give greater facilities to vessels entering and leaving.

The sum of $3,000 having been appropriated by the river and harbor act of August 17, 1894, for continuing this improvement, proposals for dredging were advertised for and opened November 9, 1894. They were regarded too high and rejected. At a second opening award was made to the Baltimore Dredging Company at 19.8 cents per cubic yard, place measurement. The contract made is for this and other improvements along the eastern shore of Chesapeake Bay, and the work upon them is to be completed by December 20, 1895.

July 1, 1894, balance unexpended	$351.33
Amount appropriated by act of August 17, 1894	3,000.00
	3,351.33
June 30, 1895, amount expended during fiscal year	342.23
July 1, 1895, balance unexpended	3,009.10
July 1, 1895, amount covered by uncompleted contracts	3,000.00
July 1, 1895, balance available	9.10
Amount (estimated) required for completion of existing project	3,700.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	3,700.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1886 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix G 18.)

19. Manokin River, Maryland.—Before improvements were commenced in 1891 the depth of water at the mouth of the river, at the so-called "Mud Flats," was between 1 and 2 feet at low tide. These flats are about 2½ miles wide, and made navigation, except at high water, impossible, thereby rendering the upper part of the river, which has a very fair depth and width, almost useless for extensive shipping purposes. The average rise of the tide at the flats is 2.6 feet.

The adopted project for improvement is for a channel 6 feet deep at mean low water and 100 feet wide from Locust Point to Sharp Point, embracing the section called the "Mud Flats," at an estimated cost of $30,000.

Up to the close of the fiscal year ending June 30, 1894, $14,535.05 had been expended, and the proposed cut across the "Mud Flats" had been made for a width of 60 feet and a depth of 6 feet at low water, which opened the river for navigation during low tide. Several sharp points in the upper river, above Sharp Point, were also removed and

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navigation upon the whole river at low tide was thereby greatly improved.

The sum of $4,000 having been appropriated by the river and harbor act of August 17,1894, for continuing this improvement, proposals for dredging were advertised for and opened November 9, 1894. The lowest bid was 29 cents per yard, place measurement. As this price was regarded excessive the bids were rejected, and the service advertised again. The second bids were for all the improvements on the eastern shore of Chesapeake Bay combined, and the lowest bid was that of the Baltimore Dredging Company, of Baltimore, at 19.8 cents per cubic yard, place measurement. This was accepted, and contract has been made requiring dredging to be completed by December 20, 1895.

July 1, 1894, balance unexpended	$464.95
Amount appropriated by act of August 17, 1894	4,000.00
	4,464.95
June 30, 1895, amount expended during fiscal year	254.24
July 1, 1895, balance unexpended	4,210.71
July 1, 1895, amount covered by uncompleted contracts	4,000.00
July 1, 1895, balance available	210.71
Amount (estimated) required for completion of existing project	11,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	2,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix G 19.)

20. Harbor and approaches at Cape Charles City, Va.—This harbor is an artificial rectangular basin of about 10 acres area, originally excavated to a depth of 12 feet in a pond just back of the shore of Chesapeake Bay about 12 miles north of Cape Charles. It is in Northampton County and forms the shore terminus of the New York, Philadelphia and Norfolk Railroad, transfer of passengers and freight being made by boat to and from Norfolk, Va. The tide rises on an average 2.6 feet.

The project for improvement proposed in a report on a survey made in 1889 provides for dredging the harbor to a depth of 14 feet and the entrance thereto and the channels in Cherrystone Inlet and across Cherrystone Bar to a depth of 16 feet below mean low water, the width at the inlet and bar to be 100 and 200 feet, respectively, and for protective works of stone at the entrance. The estimated cost of the project is $142,340, of which $45,400 is for dredging.

The dredging project was adopted in 1890, and at the end of the fiscal year ending June 30, 1894, $23,210.93 had been expended in dredging about one-half of the area of the harbor to a depth of 14 feet, in widening the channel in the entrance and deepening it to 16 feet, and in removing part of the shoal in Cherrystone Inlet about a mile below the harbor,to the same depth. The improvements are of great benefit to the large class of vessels that daily leave and enter the harbor.

The dredged channels are supposed to be in a fair condition, except the one at the entrance, which has partially shoaled again and needs protective works.

No work was done during the past fiscal year, and the appropriation of $10,000 made July 13, 1892, is still on hand, as the owners have not yet filed an acceptance of the conditions upon which the appropriation was made.

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July 1, 1894, balance unexpended	$11,789.07
June 30, 1895, amount expended during fiscal year	100.00
July 1, 1895, balance unexpended	11,689.07
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	10,400.00

(See Appendix G 20.)

21. Removing sunken vessels or craft obstructing or endangering navigation.—Wreck of canal boat Loring Monroe, in Brandywine Creek, Delaware.—The work of removal was begun June 29, 1894, and completed July 3, 1894, and the channel left clear of obstructions. Cost, $282.49.

Wreck of schooner Mint, in Leipsic River, Delaware.—This schooner, about 75 tons burden, was sunk and submerged in 15 feet of water, about 4 miles above the mouth of the river. Her stern projected into the channel. Work of removal began January 11 and was completed January 16, 1895, at an expense of $375.98.

Wrecks in Cambridge Harbor and Choptank River, Maryland.—The mast, with rigging, of the wrecked sloop *John Thomas*, in the Choptank River, sunk in March, 1895, being an obstruction to navigation, was torn off and removed; and the wreck in Cambridge Harbor, believed to be the *Eldridge*, sunk about nine years ago, and stripped of decks, etc., was found lying near the drawbridge with her stern projecting into the channel. The obstructive portion of it, about 15 feet, was broken off and removed. The work on both these wrecks was completed June 19, 1895, at a cost of $11.

(See Appendix G 21.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations and surveys of the following localities, required by the act of August 17, 1894, were made by the local engineer, W. F. Smith, United States agent, major of Engineers, United States Army, retired, and reports thereon submitted through the Division Engineer, Col. W. P. Craighill, Corps of Engineers:

1. Preliminary examination of Christiana River above Wilmington to Newcport, Del.—Major Smith submitted report of examination November 16, 1894. He is of opinion that the present and prospective demands of commerce warrant the improvement of this river, and the division engineer reports the locality worthy of improvement by the United States. The views of these officers are concurred in by this office. No additional appropriation is recommended for a survey, as one is now in progress, having been ordered by the act of August 17, 1894, which, when finished, will furnish all necessary information for plan and estimate of cost of improvement. The report was transmitted to Congress and printed in House Ex. Doc. No. 74, Fifty-third Congress, third session. (See also Appendix G 22.)

2. Preliminary examination of Mahon River, Delaware.—Major Smith submitted report of examination September 12, 1894. It is his opinion and that of the division engineer, concurred in by this office, that the river is not worthy of improvement by the General Government at this time. The report was transmitted to Congress and printed in House Ex. Doc. No. 35, Fifty-third Congress, third session. (See also Appendix G 23.)

3. Preliminary examination of the mouth of Broadkiln River, Delaware.—Major Smith submitted report of examination September 6, 1894. It is his opinion, concurred in by the division engineer and by this office,

the locality is not worthy of improvement by the General Government at this time. The report was transmitted to Congress and printed in House Ex. Doc. No. 70, Fifty-third Congress, third session. (See also Appendix G 24.)

4. Preliminary examination for a canal from Pocomoke River, Maryland, to Indian River, Delaware.—Major Smith submitted report of examination September 10, 1894. It is his opinion, concurred in by the division engineer and by this office, that a canal from Pocomoke to Indian rivers is an improvement not worthy of being undertaken by the General Government at this time. The report was transmitted to Congress and printed in House Ex. Doc. No. 80, Fifty-third Congress, third session. (See also Appendix G 25.)

5. Preliminary examination of Hunting Creek, Virginia, from its mouth to head of navigation.—Major Smith submitted report of examination September 25, 1894. It is his opinion and that of the division engineer, concurred in by this office, that this creek is not worthy of improvement by the General Government at this time. The report was transmitted to Congress and printed in House Ex. Doc. No. 64, Fifty-third Congress, third session. (See also Appendix G 26.)

6. Preliminary examination for internal waterway, extending from Franklin City, Va., southward to Cape Charles.—Major Smith submitted report of examination October 29, 1894. He does not think that the present commerce is sufficient to warrant the Government in undertaking the work. The division engineer considers that this waterway is not worthy of improvement by the General Government, and this opinion is concurred in by this office. The report was transmitted to Congress and printed in House Ex. Doc. No. 83, Fifty-third Congress, third session. (See also Appendix G 27.)

7. Survey of Rock Hall Harbor, Maryland.—The duty of making this survey having been assigned to Major Smith, he reported that as a complete survey of this harbor was made under his direction in 1891, and a project and estimate of cost of its improvement submitted under date of September 26, 1891, published in the Annual Report of the Chief of Engineers for 1892, pages 1001–1003, a new survey at this time is not deemed necessary. He therefore recommended that a reexamination of the locality be made, with a view to determining any changes that might be found necessary. His recommendation was approved, and a report of the results of the reexamination authorized was submitted December 27, 1894. The division engineer, in forwarding the report, states "that this locality is worthy of improvement by the United States to the extent of dredging a cut across Swan Point Bar, at a cost of $9,600, leaving to those interested to do the dredging necessary in the interior basin to enable boats to reach the pier at the town of Rock Hall." The report was transmitted to Congress and printed in House Ex. Doc. No. 200, Fifty-third Congress, third session. (See also Appendix G 28.)

8. Survey of Nanticoke River, in Delaware.—Major Smith submitted report February 7, 1895. The project recommended by him is for a 9-foot channel 100 feet wide, the width to be increased to 150 feet at sharp turns and the channel to be made fan-shaped at the upper end near the county bridge at Seaford, to give more room for vessels turning round. The estimated cost of this improvement is $13,000. The report was transmitted to Congress and printed in House Ex. Doc. No. 323, Fifty-third Congress, third session. (See also Appendix G 29.)

9. Survey of Pocomoke River, Maryland, with a view of uniting the waters of said river with the waters of Sinepuxent Bay at a point above Snow Hill, and of improving said river between Snow Hill and Shad

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Landing.—The report of the results of this survey was submitted by Major Smith under date of February 25, 1895, and he states that a cut 20 feet wide at bottom and 6 feet below mean low water through the land from Sinepuxent Bay to Pocomoke River will require the removal of about 2,756,360 cubic yards of material, at an estimated cost, including the construction of four bridges, of $564,272, and that to make a channel 9 feet in depth at mean low water and 100 to 130 feet in width in the Pocomoke River from Snow Hill to Shad Landing will require the removal of 70,000 cubic yards of material, at an estimated cost of $14,000.

In view of its great cost, Col. William P. Craighill, Corps of Engineers, the division engineer, does not recommend the beginning of this work of improvement under present conditions, except below Snow Hill. (See Appendix G 30.)

10. Survey of Susquehanna River from a point 1 mile below Havre de Grace to a point 1 mile above Port Deposit, Md.—The river and harbor act of August 17, 1894, in the item making appropriation for improving Susquehanna River, provides for a survey from a point 1 mile below the town of Havre de Grace to a point 1 mile above Port Deposit, to ascertain what is necessary to prevent the accumulation of ice and ice gorges in said river, and the cost thereof. The survey thus provided for was assigned to the charge of Major Smith, and his report of the results was submitted to this office under date of April 17, 1895. He states that if a good and deep channel can be formed for the ice to find its way to the west of Watson Island the ice jam might be prevented, and, in his opinion, this end may be effected at an estimated cost of $34,040, by deflecting works placed approximately as laid down on the chart submitted.

Colonel Craighill, the division engineer, in forwarding Major Smith's report, uses the following language:

> I am decidedly of the opinion that the best means for preventing an ice gorge near Port Deposit or lessening its extent is a powerful iceboat, and this belief is strengthened by experience with ice on the Delaware, Patapsco, and other rivers in this country and in Europe.

He further remarks that "it should be understood that this work, if undertaken by the United States, is not for the benefit of navigation," and states that the cheapest method for the United States to deal with the ice gorges is to let them alone and pay the damages. He estimates that a suitable iceboat will cost, exclusive of maintenance and operating expenses, $70,000. (See Appendix G 31.)

IMPROVEMENT OF PATAPSCO RIVER AND BALTIMORE HARBOR, MARYLAND, AND JAMES RIVER, VIRGINIA; PROTECTION OF JAMESTOWN ISLAND, VIRGINIA; ROUTE FOR CHESAPEAKE AND DELAWARE CANAL.

These works were in the charge of Col. (now Brig. Gen.) William P. Craighill, Corps of Engineers, to May 18, 1895, and Lieut. Col. Peter C. Hains, Corps of Engineers, since that date.

1. Patapsco River and Channel to Baltimore, Md.—The depth of this channel has by successive steps been increased from 17 feet at mean low water to 27 feet, with an average rise of tide of about 18 inches.

The project of improvement first adopted and commenced in October, 1853, had for its object to give a channel 22 feet deep at mean low water with a width of 150 feet.

Little was done before the late war, but afterwards these dimensions were increased, a depth of 24 feet at mean low water being determined upon, with a width of channel ranging from 250 to 400 feet.

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This channel was completed in 1874, important changes of position having been given to a portion of it, by which the distance was materially lessened and the expense of maintenance decreased.

The object of the improvement was to permit the approach to Baltimore, at mean low water, of vessels drawing from 22½ to 23 feet, and at ordinary high water of vessels drawing 24 and 24½ feet. Later the project had in view a depth of 27 feet at mean low water, with a width of 600 feet, to allow the entrance and departure of the largest vessels.

Up to June 30, 1894, the United States had expended $3,203,956.47. The city of Baltimore and the State of Maryland, chiefly the former, have also contributed to the same object more than $500,000. The expenditure up to June 30, 1895, by the United States was $3,231,705.92.

In 1890 Congress gave authority for contracting for the completion of the work, which was accomplished in 1892, the channel being made 600 feet wide and 27 feet deep throughout at mean low water, the width being much greater at the turns.

A careful survey made in 1893–94 shows that the channel generally was in good condition with the exception of the turns at the intersection of the several divisions, where there are shoalings in parts, and in the Craighill division, where a very considerable shoaling was found on the outer boundaries. The channel will require repairs from time to time like all other artificial highways. The annual expenditure of $50,000, heretofore estimated, will maintain the channel in proper condition if regularly appropriated. This is, however, a small sum when contrasted with the great gain to Baltimore and her dependent interests, as well as in revenue to the United States Treasury, by the increase of the depth from 17 to 27 feet at low water, which means the introduction of many lines of deep ocean steamers to European and other foreign and domestic ports within the past twenty years, whereas there were none before of any importance. The expense of repairs is increased if they are not regularly and systematically made.

Of the $150,000 estimated for repairs in the nearly three years elapsed since the completion of the channel, but $50,000 was appropriated August 17, 1894. The contract for its expenditure was made with the Baltimore Dredging Company, dated October 17, 1894, and the work is to be completed September 1, 1895. Under that contract the lower angle of the cut-off division has been widened 80 feet, giving a total width of 1,330 feet, and the contractors are now engaged in widening the upper angle.

By direction of Congress an estimate for widening the channel to 1,000 feet was submitted September 19, 1894. This estimate amounted to the sum of $2,500,000. and the report of the survey is contained in House Ex. Doc. No. 57, Fifty-third Congress, third session. It is also printed herewith in Appendix H 7.

July 1, 1894, balance unexpended		$2,870.69
Amount appropriated by act of August 17, 1894		50,000.00
		52,870.69
June 30, 1895, amount expended during fiscal year		27,749.45
July 1, 1895, balance unexpended		25,121.24
July 1, 1895, outstanding liabilities	$250.00	
July 1, 1895, amount covered by uncompleted contracts	6,479.84	
		6,729.84
July 1, 1895, balance available		18,391.40
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		100,000.00

(See Appendix H 1.)

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2. Channel to Curtis Bay, in Patapsco River, Baltimore Harbor, Maryland.—The river and harbor act of 1892 contained the following item:

Improving Patapsco River, Baltimore Harbor, Maryland: For dredging a channel 150 feet wide at bottom and of a depth of 27 feet mean low water from the main ship channel to Curtis Bay, in accordance with recommendation of Col. William P. Craighill, Corps of Engineers, submitted December 13, 1890, $28,000.

The total estimated cost of the improvement was $85,000. The above appropriation was expended in dredging by contract a channel 150 feet wide to a depth of 25 feet at mean low water, which was completed in May, 1893.

An appropriation of $12,000 was made August 17, 1894. The channel already dredged answers all present needs, and it has been decided to hold the new appropriation until its expenditure is required.

Amount appropriated by act of August 17, 1894	$12,000.00
July 1, 1895, balance unexpended	12,000.00
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	45,000.00

(See Appendix H 2.)

3. James River, Virginia.—When the improvement of the James River was regularly undertaken by the Government the navigation was obstructed by sunken vessels, by remains of military bridges, and by other obstructions put into the river during the late war to prevent the National fleets from approaching too close to Richmond.

There were also other natural obstructions. Rockett Reef and Richmond Bar had only 7 feet of water at mean low tide. From Warwick Bar to Richmond the channel was crooked and obstructed by dangerous rocks and ledges. The Dutch Gap cut-off was not then open, and the river was in a poor condition as regards its availability for commercial purposes.

The original project of improvement was to secure a depth of 18 feet at full tide (corresponding to about 15 feet at low tide) to Richmond, with a channel width of 180 feet. This project had reached an advanced state of progress when Congress by act approved July 5, 1884, adopted another looking to 22 feet at mean low tide from the sea to Richmond, the width to be 400 feet from the sea to City Point, 300 feet thence to Drewry Bluff, and 200 feet thence to Richmond.

The total amount expended on this river by the United States up to June 30, 1894, was $1,456,783.14, which includes the sum of $725,898.59 expended since the new project was entered upon to give a depth of 22 feet at mean low water. The condition of the river June 30, 1894, is shown by the table below, the depth being given at mean low water, as also, for comparison, the depths in 1870 before improvement was begun, with a channel width not less than 80 feet:

Locality.	Length.	1870.	1894.
	Miles.	*Feet.*	*Feet.*
Richmond to Goodes Rocks	2	8	16
Goodes Rocks	.25	7	13.8
Richmond Bar	.75	7	16
Richmond Bar to Drewry Bluff	3.75	9	18
Drewry Bluff to Curles	14	*7	16.7
Curles to Hampton Roads	79.75	14.8	17

* In bend at Dutch Gap, now avoided by cut-off.

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The amount expended in the year ending June 30, 1895, is $94,630.22.

The most expensive and tedious part of the improvement is near the city of Richmond, where the depth of water is least and much of the material to be removed to give greater depth is rock. Where the material is such that an increase of velocity given by contracting and regulating works can remove it, and thus obtain and then maintain the required depth, these works have been successful and the results good. The conditions are now such that the best results can be obtained from liberal appropriations.

In the fiscal year contracts have been in force with Mr. John A. Curtis, dated October 15, 1892, completed May 21, 1895, and with Mr. P. Sanford Ross, dated December 11, 1894.

The work required under the contract with Mr. Curtis included the enlargement of the channel between Richmond city limits and Goodes Rocks to not less than 80 feet wide and 18 feet deep; the widening of Goodes Rocks cut to 80 feet and the channel through Richmond Bar to 80 feet by 18 feet; the deepening of Dutch Gap cut-off to 25 feet for 100 feet of its width, and redredging and enlarging the channels at Harrisons Bar and Goose Hill Flats to 200 by 18 feet. In works of regulation the wing dams on Richmond Bar and from Warwick Bar to Drewry Bluff were to be extended to new lines of contraction, and wing dams constructed for the first time in Wards Reach, Willis Reach, and at Curles. Two of the wing dams at Varina, built in 1880 and shortened by the freshet of 1886, were to be restored, and new wing dams constructed on the right bank covering the whole length of the shoal, to produce further contraction and scour out the channel 300 by 22 feet, required by the project of 1884. The openings in training walls below Richmond Bar and in Kingsland Reach were to be closed.

Mr. Curtis, in the fiscal year 1895, has removed 63,420.2 cubic yards of earth, 529.8 cubic yards of cobblestone, 3,769.7 cubic yards of soft rock, and 6,963.7 cubic yards of solid rock, a total of 74,683.4 cubic yards.

The work required under the contract with Mr. Ross included the enlargement of the channel for 2½ miles below Richmond to 100 feet wide, and 18 feet deep except in solid rock which may be extended to 22 feet deep at the option of the engineer; the removal of the remains of military obstructions at Drewry Bluff to give a width of 300 feet and an available depth of 22 feet; the widening of the channel at Harrisons Bar for about a mile and a half to 350 feet by 21 feet depth, and redredging the channel at Goose Hill Flats to 200 by 18 feet.

Mr. Ross, in the fiscal year 1895, has removed 116,251.5 cubic yards of earth.

The condition of the channel June 30, 1895, is shown in the following table, the depths being at mean low water in a channel not less than 80 feet wide, the minimum width being in rock:

Locality.	Length.	1870.	1895.
	Miles.	*Feet.*	*Feet.*
Richmond to Goodes Rocks	2	8	16.5
Goodes Rocks to Curles	18.25	7	18
Curles	.50	14	17.5
Curles to Hampton Roads	80	14.8	18

The present available depth for navigation at full tide from the sea to the lower city limits of Richmond is 20 feet.

It is estimated that when the proposed improvement is completed an annual expenditure of $20,000 will be necessary for the maintenance of the channel.

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July 1, 1894, balance unexpended		$107,680.07
Amount appropriated by act of August 17, 1894		100,000.00
		207,680.07
June 30, 1895, amount expended during fiscal year		94,630.22
July 1, 1895, balance unexpended		113,049.85
July 1, 1895, outstanding liabilities	$2,000.00	
July 1, 1895, amount covered by uncompleted contracts	55,923.16	
		57,923.16
July 1, 1895, balance available		55,126.69

Amount (estimated) required for completion of existing project	3,236,070.45
Amount that can be profitably expended in fiscal year ending June 30, 1897	150,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix H 3.)

4. Protection of Jamestown Island, Virginia.—The river and harbor act of August 17, 1894, contained the following item:

Protecting Jamestown Island from the encroachments of James River, ten thousand dollars, or so much thereof as may be necessary.

The abrasion of the shore of the island has been going on for years and had reached a condition that required checking if the old landmark was to be preserved. The injury has been caused by the action of the waves raised by the winds in the broad stretch above. These waves undermined the banks. The worst winds are from northwest to west, next those from southeast to south, but north and south winds are also hurtful.

The plan adopted was to build a wall faced with granite in front of the threatened part of the island, to grade and turf the bluff behind it, and to add several groins in front of the wall. This work was completed June 5, 1895, under a contract dated December 26, 1894, after inviting proposals.

Amount appropriated by act of August 17, 1894	$10,000.00
June 30, 1895, amount expended during fiscal year	9,141.48
July 1, 1895, balance unexpended	858.52

(See Appendix H 4.)

5. Route for the construction of the Chesapeake and Delaware Canal.—By the river and harbor act of August 17, 1894, the President of the United States was authorized to appoint a Board to consist of—

an officer of the Engineer Corps of the United States Army not below the rank of lieutenant-colonel, an officer of the United States Navy not below the rank of captain, and two civilians, who, together with the Chief of Engineers of the United States Army, shall examine and determine, from the surveys heretofore made under the direction of the War Department, the most feasible route for the construction of the Chesapeake and Delaware Canal.

Under date of October 9, 1894, the Secretary of War informed the Chief of Engineers, United States Army, that the President had selected Brig. Gen. Thomas L. Casey, Chief of Engineers; Col. William P. Craighill, Corps of Engineers; Capt. George Dewey, United States Navy; Mr. Mendes Cohen, of Maryland, and Mr. E. Porter Alexander, of South Carolina, to compose the above-mentioned Board, and directed the Chief of Engineers to take the necessary action in the premises.

The Board submitted its report under date of December 8, 1894, which was transmitted by the Secretary of War to the Speaker of the House of Representatives December 11, 1894, and printed as House Ex. Doc. No. 102, Fifty-third Congress, third session.

(See also Appendix H 5.)

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EXAMINATION AND SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examination and survey of the following localites, required by the act of August 17, 1894, were made by the local engineer, Col. William P. Craighill, Corps of Engineers, and reports thereon submitted:

1. Preliminary examination of harbor at Claiborne, Md., the west terminus of the Baltimore and Eastern Shore Railroad.—Colonel Craighill submitted report of examination November 7, 1894. He is of opinion, concurred in by this office, that the locality is not worthy of improvement by the General Government at this time. The report was transmitted to Congress and printed in House Ex. Doc. No. 61, Fifty-third Congress, third session. (See also Appendix H 6.)

2. Survey of Baltimore Harbor, Maryland.—Colonel Craighill submitted report of survey September 19, 1894, in which he states that the cost of widening the ship channel to 1,000 feet, including superintendence, is estimated to be $2,500,000. The report was transmitted to Congress and printed in House Ex. Doc. No. 57, Fifty-third Congress, third session. (See also Appendix H 7.)

IMPROVEMENT OF POTOMAC RIVER AND ITS TRIBUTARIES, AND OF CERTAIN RIVERS IN VIRGINIA ON WESTERN SHORE OF CHESAPEAKE BAY.

This district was in the charge of Maj. Charles E. L. B. Davis, Corps of Engineers, with Lieut. David DuB. Gaillard, Corps of Engineers, under his immediate orders since February 12, 1895; Division Engineers, Col. William P. Craighill, Corps of Engineers, to May 18, 1895, and Lieut. Col. Peter C. Hains, Corps of Engineers, since that date.

1. Potomac River at Washington, D. C.—Before the commencement of this improvement the channel to Georgetown, D. C., was narrow and crooked, and had not sufficient depth to meet the needs of commerce. Vessels drawing 16 feet frequently grounded at high tide above Long Bridge, and frequent dredging was necessary to maintain even this depth. The channel was of insufficient width, as the appropriations for dredging were too small to provide for more than a narrow cut through the bar. The Washington Channel was narrow and shoal, and inadequate to the wants of commerce. Extensive mud flats existed along the city front from Observatory Hill to a point opposite the Arsenal. Below Long Bridge these flats were separated from the city front by the Washington Channel. The greater portion of these flats was exposed at low tide and covered at high tide with water polluted by the sewage of the city. At the foot of Seventeenth street NW. a large sewer discharged directly upon the flats. These conditions rendered a portion of the city almost uninhabitable.

By act passed August 2, 1882, Congress adopted a project which has for its object the improvement of the navigation of the river by widening and deepening its channels, the reclamation or filling of the marshes on the city front by depositing on them the material dredged from the channels, and the establishment of harbor lines beyond which no wharves or obstructions should be built. The project provides in detail for such depths of channels as will accommodate the largest vessels that can reach Arsenal Point, with such depth at the wharves as will allow vessels to receive full cargoes without grounding at low water; for filling the flats above Long Bridge to a height of 3 feet above the flood line of 1877, and the middle part of the flats below Long Bridge to the

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same height, but sloping each way to a height of 6 feet above low tide at the margin of the fill; that, in order to purify the water in the Washington Channel, which will be cut off at its upper end from the Virginia, or main channel, a tidal reservoir or basin be established above Long Bridge, to be filled with water from the Virginia Channel on the flood tide and discharged into the Washington Channel on the ebb.

The plan also contemplates the rebuilding of Long Bridge with longer spans and fewer piers during the progress of the work, and the interception of all sewage now discharged into Washington Channel and its conveyance to James Creek, but neither the reconstruction of the bridge nor the building of the intercepting sewer was included in the estimate of the cost of the improvement.

Up to the close of the fiscal year ending June 30, 1894, $1,983,467.68 had been expended and the following work had been done: The Virginia Channel had been dredged 20 feet deep and 350 to 550 feet wide between Georgetown and Giesboro Point, and as above the Long Bridge this channel had filled up it has been redredged several times, and a training dike has been commenced on the westerly side of the channel to reduce the deposit by contracting the waterway. The Washington Channel had been dredged to a depth of 20 feet and a width of 350 feet throughout its entire length and to a depth of 12 feet from the 20-foot channel nearly to the easterly margin of the fill. This channel was maintained fairly well until the freshet of June, 1889, when considerable shoaling took place. The construction of the sea wall, for the protection of the margin of the fill from erosion by waves and the action of tidal currents and freshets, had been entirely completed below the Long Bridge, a total length of 25,495 feet. The Reservoir Outlet at the head of the Washington Channel had been completed with the exception of the railing.

During the fiscal year ending June 30, 1895, dredging was continued under contract until completed July 26, 1894, 198,257 cubic yards having been removed under this contract. Under the new appropriation of August 17, 1894, a new contract was made for dredging in Potomac River, and 202,483 cubic yards was dredged from the Virginia Channel and 221,742 cubic yards from the Washington Channel. Work on the sea wall around the edge of the Tidal Reservoir was commenced and good progress made, 1,300 feet of wall having been completed at the close of the fiscal year, and the training dike on the westerly side of the Virginia Channel above the Long Bridge was extended, the total length being 3,200 feet.

Long Bridge.—On June 30, 1892, the northerly end of the Long Bridge across the Washington Channel had been nearly reconstructed by the Baltimore and Potomac Railroad Company on plans approved by the Secretary of War, the work being incomplete owing to the settlement and movement of the abutments.

Reference is made in the report of the officer in local charge to the necessity of rebuilding Long Bridge. In event of a freshet occurring when the Potomac River is full of ice great damage is to be expected. The piers of the bridge are of such faulty construction that an ice gorge would be probable, which would cause the water to back up and overflow portions of the city front and through the sewers above the bridge such portions of the lower parts of the city as may be drained by them. Great damage was done by the freshet of June, 1889, but greater damage may occur from a freshet of lesser magnitude if accompanied by an ice gorge.

A plan for the reconstruction of the bridge was submitted to Congress April 5, 1890.

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The officer in charge of this improvement makes the recommendation that a clause be inserted in the next appropriation bill to the effect that the reclaimed area shall not be given to commercial uses but shall be set apart for park purposes.

July 1, 1894, balance unexpended		$51,532.32
Amount appropriated by act of August 17, 1894		150,000.00
		201,532.32
June 30, 1895, amount expended during fiscal year		104,579.65
July 1, 1895, balance unexpended		96,952.67
July 1, 1895, outstanding liabilities	$2,273.00	
July 1, 1895, amount covered by uncompleted contracts	14,972.00	
		17,245.00
July 1, 1895, balance available		79,707.67

Amount (estimated) required for completion of existing project	531,365.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	150,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix I 1.)

2. Anacostia River, at Washington, D. C.—The channel of the Anacostia River, District of Columbia, was obstructed between its mouth and the Washington Navy-Yard by three bars, on two of which there were ruling depths of 18 feet, and on the third a ruling depth of about 19 feet. The channel is exceedingly narrow and tortuous and vessels of moderate length navigate it with difficulty.

The project for the improvement of the Anacostia River provides for dredging a channel 24 feet deep and 200 feet wide from its mouth to the navy-yard bridge, the channel to be widened with a reduced depth to 1,000 feet, as the demands of commerce require.

In front of the navy-yard a basin is proposed 400 feet wide and 24 feet deep. The material dredged is to be deposited on the flats of the river, and the estimated cost of the improvement is $656,000.

Up to June 30, 1894, $18,121.94 had been expended, and channels 200 feet wide and 20 feet deep were dredged through two shoals. A basin from 100 to 200 feet wide and 22 feet deep has been dredged at the navy-yard by the Navy Department. No work has been done during the fiscal year ending June 30, 1895, for want of funds.

July 1, 1894, balance unexpended	$1,773.06
July 1, 1895, balance unexpended	1,773.06

Amount (estimated) required for completion of existing project	636,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

(See Appendix I 2.)

3. Occoquan Creek, Virginia.—Occoquan Creek is a tributary of the Potomac River, which it enters about 25 miles below Washington, D. C. Navigation was obstructed by four bars, which were improved between 1873 and 1880 by the expenditure of four appropriations, aggregating $25,000, giving a navigable depth of about 6 feet to Occoquan, the head of navigation, 4 miles above the mouth. When the original survey was made, November, 1872, the ruling depths over the several bars were as follows: Lower Mud, 2.7 feet; Sand Bar, 4 feet. Occoquan Bar does not appear to have been in existence. A narrow channel had been dredged by the citizens at the Upper Mud, having a depth of 6 feet. In compliance with the provisions of the river and

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harbor act of August 11, 1888, a new survey was made in 1889, and the condition of the several bars found as follows:

Lower Mud, about 3.5 miles below Occoquan. This bar is about 4,000 feet long and had a ruling depth of about 3 feet. The former dredged channel had filled in.

Upper Mud, about 2.25 miles below Occoquan. The channel dredged in 1874–75 was found to have maintained its original dimensions, being about 50 feet wide and from 5 to 6 feet deep.

Sand Bar, about one-half mile below Occoquan. The former dredged channel had filled in, the least depth being 4.2 feet.

Occoquan Bar, a short bar opposite Occoquan. The channel dredged here had filled in, and the least depth was 4 feet.

The project for the new improvement comprises the dredging of channels 6 feet deep and from 100 to 150 feet wide through the bars, with the construction of such dikes as may be required to maintain the depth secured by dredging. The first appropriation for the new work was made September 19, 1890.

At the close of the fiscal year ending June 30, 1894, $14,433.30 had been expended. A channel 6 feet deep and from 100 to 150 feet wide had been dredged through the Lower Mud. A width of 100 feet and a depth of 6 feet had been secured at the Sand Bar. A channel 8 feet deep and 100 feet wide had been dredged through Occoquan Bar and the dike at the bar nearly completed. The channel at the Upper Mud had been completed 1,350 feet in length, of the required dimensions of 100 feet in width, and 6 feet in depth.

During the fiscal year ending June 30, 1895, sunken logs were removed from the mouth of the creek; under contract, 6,420 cubic yards of material was dredged at Occoquan Bar and at Sand Bar; unfavorable bids having been received for furnishing stone, that material was purchased in open market, and the dike at Occoquan Bar was completed and 802 feet of dike constructed at Sand Bar.

July 1, 1894, balance unexpended	$566.70
Amount appropriated by act of August 17, 1894	5,000.00
	5,566.70
June 30, 1895, amount expended during fiscal year	5,274.60
July 1, 1895, balance unexpended	292.10
July 1, 1895, outstanding liabilities	189.00
July 1, 1895, balance available	103.10
Amount (estimated) required for completion of existing project	25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	2,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix I 3.)

4. Aquia Creek, Virginia.—Aquia Creek is a tributary of the Potomac River, which it enters about 41 miles below Washington, D. C. The stream is about 7 miles long, and in 1872 its navigation was chiefly obstructed by shoals between the mouth and the "Narrows," 4.5 miles above. Here the creek takes the character of a wide bay, from 1,000 to 6,000 feet wide, while the depth of water ranged from 2 to 4 feet over an almost continuous shoal of soft mud. Above the "Narrows" the creek is from 60 to 200 feet wide, with a depth of from 2 to 17 feet, the shoaler portions being near the head of navigation. The stream is crossed by a bridge of the Richmond, Fredericksburg and Potomac Railroad, about 3 miles above the mouth, the draw of the bridge being but 28 feet wide.

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From 1872 to 1878 appropriations amounting to $10,000 were made by Congress, and the navigation improved by dredging a channel from 40 to 50 feet wide, and from 4 to 5 feet deep, through the shoaler parts of the creek, chiefly above the railroad bridge.

A new survey of the creek was provided for in the river and harbor act of August 11, 1888, and was made in 1889. The channel dredged from 1872 to 1878 was found to have maintained its dimensions between the railroad bridge and the "Narrows," but at other places it had filled in. The general depth of water in the creek remained substantially as in 1872. Estimates for improving the navigation were submitted January 18, 1890, and an appropriation of $10,000 was made by the river and harbor act of September 19, 1890.

The project for the improvement, approved December 4, 1890, proposes a channel 80 feet wide and 6 feet deep, dredged through the shoals where less than 6 feet is found between the mouth of the creek and the "Narrows."

At the close of the fiscal year ending June 30, 1894, $13,565.23 had been expended. A channel 80 feet wide and 6 feet deep had been dredged from Thorny Point, at the lower end of the shoal, to a point 3,823 feet above the railroad bridge, giving a channel of the prescribed width and depth 15,103 feet in length.

During the fiscal year ending June 30, 1895, a total of 17,731 cubic yards of material was dredged, widening and deepening the channel above the railroad bridge to the required dimensions for a length of 1,550 feet, leaving 1,110 feet yet to be dredged.

July 1, 1894, balance unexpended	$1,434.77
Amount appropriated by act of August 17, 1894	3,000.00
	4,434.77
June 30, 1895, amount expended during fiscal year	3,455.81
July 1, 1895, balance unexpended	978.96
July 1, 1895, outstanding liabilities	205.00
July 1, 1895, balance available	773.96
Amount (estimated) required for completion of existing project	22,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	3,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix I 4.)

5. Nomini Creek, Virginia.—This stream is an important tributary of the Potomac, which it enters about 82 miles below Washington, D. C.

Navigation was obstructed in 1872 by a bar of sand and oyster shells at its mouth, over which but 3 feet could be carried at low tide, and the dangers and difficulties of passing the bar were further increased by a rapid current and cross tides. After passing the bar 8 feet can be carried to Nomini Ferry, about 4 miles above the mouth.

The original project for the improvement, adopted in 1873, provided for dredging a channel 100 feet wide and 9 feet deep through the bar. The project was modified in 1879 by increasing the width to 150 feet, and again in 1885 by increasing the width to 200 feet. In 1890 a further modification was made, proposing the construction of two jetties parallel to the outer channel, retaining the width of dredging at 150 feet. The total cost of this modified project was placed at $72,500. At the close of work in 1883 a channel about 100 feet wide and 9 feet deep had been dredged through the bar. During the suspension of work from 1883 to 1889 the cut was reduced in depth and width by deposits of sand.

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In 1889 the outer channel was widened and redredged on the westerly side for a width of 94 feet and a length of 1,470 feet, the depths being from 8.9 to 13.8 feet.

During the fiscal year ending June 30, 1891, the channel at and outside of White Point was dredged, the width attained being from 130 to 150 feet, and the depth 9 feet. A riprap dike was built inside White Point to check the cross tidal currents.

At the close of the fiscal year ending June 30, 1894, $46,244.06 had been expended, and 465 feet of the east jetty outside of White Point had been completed of the 890 feet that was to be built under the contract.

During the fiscal year ending June 30, 1895, after long delays on the part of the contractor, the contract was closed, only 819 feet of dike having been completed, owing to the exhaustion of the funds available for this work.

A contract was entered into for dredging about 17,000 cubic yards of material, and work will be commenced in the near future.

July 1, 1894, balance unexpended	$6,255.94
Amount appropriated by act of August 17, 1894	5,000.00
	11,255.94
June 30, 1895, amount expended during fiscal year	4,948.87
July 1, 1895, balance unexpended	6,307.07
July 1, 1895, amount covered by uncompleted contracts	3,910.00
July 1, 1895, balance available	2,397.07

Amount (estimated) required for completion of existing project	15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	1,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix I 5.)

6. Lower Machodoc Creek, Virginia.—Lower Machodoc Creek is a tributary of the Potomac River, which it enters on the right about 85 miles below Washington, D. C. It has a navigable length of about 4 miles, and the lower part of the stream affords a good harbor for vessels drawing 12 feet or less. In 1892 navigation was obstructed by a bar at the "Narrows," 2 miles above the mouth, over which but 4 feet could be carried at low tide. After passing the bar, depths of from 10 to 14 feet are found, gradually diminishing, however, to about 6 feet at Drum Bay, the head of navigation.

The project for the improvement, based on the survey of 1892, made subsequent to the appropriation of July 13 of that year, provides for dredging a channel 9 feet deep and 150 feet wide through the bar at the "Narrows," at an estimated cost of $15,000.

The first appropriation for the improvement was made July 13, 1892, the amount being $3,000.

At the close of the fiscal year ending June 30, 1894, $2,863.39 had been expended in making a survey of the bar and in dredging a channel 150 feet wide and 6 feet deep through the Narrows Bar, being all the funds available would permit.

During the fiscal year ending June 30, 1895, a contract was entered into for dredging about 10,400 cubic yards of material to deepen and widen the channel through the bar. The same party has the contract for dredging at Nomini Creek, and when he is through there, work will be commenced at Lower Machodoc Creek.

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July 1, 1894, balance unexpended	$136.61
Amount appropriated by act of August 17, 1894	3,000.00
	3,136.61
June 30, 1895, amount expended during fiscal year	20.60
July 1, 1895, balance unexpended	3,116.01
July 1, 1895, amount covered by uncompleted contracts	2,392.00
July 1, 1895, balance available	724.01

Amount (estimated) required for completion of existing project	9,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	1,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix I 6.)

7. *Rappahannock River, Virginia.*—The obstructions to navigation of the Rappahannock River before improvement were nine bars between Tappahannock, 41 miles above the mouth, and Fredericksburg, 106 miles above the mouth, over which the ruling depths were from 4 to 10.5 feet. The chief obstructions were in the 12.5 miles of river below Fredericksburg, where seven of the bars are found. Of these bars, Fredericksburg Bar, with a least depth of 4 feet, and Spottswood Bar, 4 miles below Fredericksburg, with a least depth of 6 feet, caused the most delay to steamboats and vessels.

The original project, adopted in 1871, proposed a channel 10 feet deep and 100 feet wide through all the bars. This was modified in 1879 by increasing the dimensions of the channel between Port Royal and Tappahannock to 15 feet in depth and 200 feet in width, to accommodate the larger class of vessels.

Up to June 30, 1894, $90,500 had been expended on the original project, and $140,634.68 on the modified project, or $231,134.68 in all. Depths of from 8.4 to 9.5 feet were secured through the bars between Fredericksburg and Port Royal by dredging and the construction of dikes. Wrecks and snags obstructing navigation were also removed. A channel 100 feet wide and 10 feet deep was dredged for a distance of 2,500 feet, while for a farther distance of 2,200 feet a width of 67 feet and a depth of 10 feet were secured through Fredericksburg Bar. The material deposited behind the dikes at this bar has been protected by brush fences from erosion during freshets.

As each recurring freshet brings additional deposits of sand and silt into the river the officer in charge recommends an annual appropriation of $7,500 for the maintenance of the improvement.

July 1, 1894, balance unexpended	$3,365.32
Amount appropriated by act of August 17, 1894	10,000.00
	13,365.32
June 30, 1895, amount expended during fiscal year	750.36
July 1, 1895, balance unexpended	12,614.96
July 1, 1895, outstanding liabilities	469.00
July 1, 1895, balance available	12,145.96

Amount (estimated) required for completion of existing project	137,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix I 7.)

8. *Urbana Creek, Virginia.*—Urbana Creek is a tributary of the Rappahannock River, which it enters 16 miles above the mouth. Before

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improvement navigation was obstructed by a bar outside the mouth, over which but 6.5 feet could be carried, and a shoal within the creek having a least depth of 7 feet.

The original project, adopted in 1879, provided for dredging a channel 150 feet wide and 10 feet deep through the outer bar. This project was extended in 1883 so as to include dredging to 10 feet through a shoal within the creek near the town of Urbana.

Up to the close of the fiscal year ending June 30, 1894, $24,484.11 had been expended. The channel through the outer bar had been dredged to the standard dimensions, the channel through the shoal within the creek dredged from 80 to 170 feet wide and 10 feet deep, and dikes and jetties built along the sand spit to check the movement of sand. This channel was widened 70 feet by dredging off the end of the sand spit.

The amount of dredging being small in quantity, it is proposed to combine it with that to be done on the Rappahannock River, and proposals will be invited for both localities as soon as the dike construction on that river is completed.

July 1, 1894, balance unexpended	$15.89
Amount appropriated by act of August 17, 1894	3,000.00
July 1, 1895, balance unexpended	3,015.89
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	7,080.00

(See Appendix I 8.)

9. York River, Virginia.—The Pamunkey and Mattaponi rivers unite at West Point, Va., to form the York River, which is 41 miles in length and empties into Chesapeake Bay about 16 miles above Old Point, Va. Prior to the commencement of the improvement navigation was obstructed by Potopotank Bar, 9 miles below West Point, on which the ruling depth was 18.5 feet; by West Point Bar, extending about 2 miles below West Point, and having a ruling depth of 15.5 feet, and by shoal water in front of the West Point wharves, at the mouth of the Pamunkey.

The original project provided for a channel 22 feet deep and 200 feet wide through these bars, with an increased width at the wharves. In 1884 the proposed channel width was increased to 400 feet, and in 1887 the project was amended so as to include the construction of a dike along the flats on the right of the channel to contract the waterway and maintain the depth dredged, which had decreased from continued silting.

Up to the close of the fiscal year ending June 30, 1894, $184,100.48 had been expended in the execution of the following work: A channel 105 feet wide and 22 feet deep was dredged in 1880–81 through Potopotank Bar, which by 1890 had shoaled to 20.8 feet. A channel 22 feet deep and from 161 to 257 feet wide, with a center cut 24 feet deep and 40 feet wide, had been dredged at West Point Bar below the wharves, but this channel had shoaled to such an extent that much redredging has been necessary. The channel in front of the West Point wharves has been dredged to a width of 160 feet and a depth of 22 feet for a length of 2,700 feet; 7,639 feet of sheet pile dike has been constructed at West Point Bar.

During the fiscal year ending June 30, 1895, 1,600 feet of brush and pile dike at the West Point Bar was completed, and mattresses weighted with bags of sand sunk along the face of the sheet pile dike to protect the bottom from erosion. After some delay dredging was commenced at the West Point Bar under contract calling for the removal of 100,000

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cubic yards of material, and at the close of the fiscal year 38,070 cubic yards had been removed.

July 1, 1894, balance unexpended		$9,649.52
Amount appropriated by act of August 17, 1894		20,000.00
		29,649.52
June 30, 1895, amount expended during fiscal year		12,456.51
July 1, 1895, balance unexpended		17,193.01
July 1, 1895, outstanding liabilities	$262.00	
July 1, 1895, amount covered by uncompleted contracts	11,466.00	
		11,728.00
July 1, 1895, balance available		5,465.01
Amount (estimated) required for completion of existing project		95,050.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix I 9.)

10. Mattaponi River, Virginia.—The Mattaponi River is navigable for small steamers from its mouth, at West Point, Va., to Ayletts, Va., a distance of about 52 miles, and can be made navigable for barges for about 26 miles above Ayletts to Munday Bridge. The obstructions to 5.5-foot navigation are five bars below Ayletts, having ruling depths of from 2.5 to 3.6 feet, and wrecks, snags, logs, and overhanging trees.

There were eight bars reported above Ayletts, but no improvement of them is proposed.

The approved project adopted in 1880 provides for a channel 40 feet wide and 5.5 feet deep through the bars below Ayletts and the removal of logs, snags, overhanging trees, wrecks, etc., as far up as Munday Bridge. The river and harbor act of July 13, 1892, directed the expenditure of $1,500 in improvement of the river between Ayletts and Guinea Bridge, near Milford Station, on the Richmond, Fredericksburg and Potomac Railroad.

Up to the close of the fiscal year ending June 30, 1894, $20,965.11 had been expended in removing obstructions to navigation between Robinson Bar and Munday Bridge, a distance of 34 miles, in building 2,226 feet of dike at Robinson Bar, and in the construction of the plant necessary for these operations. No dredging has ever been done.

As the original project was based on a reconnoissance it was decided to have a survey made of this river, and for this purpose a party was sent into the field as soon as the high water in the spring of 1895 would permit, and at the close of the fiscal year ending June 30, 1895, the survey party had reached a point 32 miles above Ayletts, which is considered fair progress, considering the high stage of water encountered.

July 1, 1894, balance unexpended		$2,334.89
Amount appropriated by act of August 17, 1894		4,000.00
		6,334.89
June 30, 1895, amount expended during fiscal year		1,836.63
July 1, 1895, balance unexpended		4,498.26
July 1, 1895, outstanding liabilities		738.00
July 1, 1895, balance available		3,760.26
Amount (estimated) required for completion of existing project		44,800.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		1,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix I 10.)

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11. Pamunkey River, Virginia.—The Pamunkey River has a navigable length of 59 miles, and empties into the York River at West Point, Va. Navigation was originally obstructed by five bars in the upper part of the river, and by snags, logs, and overhanging trees.

The project was adopted in 1880 and amended in 1885, and provides for channels 100 feet wide and 7 feet deep through Spring Bar and Skidmore Bar, or to a distance of 47 miles above West Point, and channels 40 feet wide and from 3 to 5 feet deep through the bars above, together with the removal of logs, wrecks, snags, and overhanging trees.

Up to the close of the fiscal year ending June 30, 1894, $18,881.02 had been expended in removing snags, logs, and overhanging trees in various portions of the river, in building dikes at Spring Bar and Skidmore Bar, in dredging a channel through the latter bar 95 feet wide and 6 feet deep, and in constructing a plant necessary for snagging operations, pile driving, etc., the appropriation for this river paying its portion of the cost of this plant.

During the fiscal year ending June 30, 1895, a survey has been made of Rockahock, Bucklands, Hogans, Spring, Skidmores, Whaleback, Potomoy Creek, and Indian Table bars, and as soon as the survey of the Mattaponi River is completed estimates of the amounts of dredging required in these two rivers will be made and proposals invited.

July 1, 1894, balance unexpended	$2,618.98
Amount appropriated by act of August 17, 1894	2,000.00
	4,618.98
June 30, 1895, amount expended during fiscal year	2,326.33
July 1, 1895, balance unexpended	2,292.65
Amount (estimated) required for completion of existing project	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	1,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix I 11.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations and surveys of the following localities, required by the act of August 17, 1894, were made by the local engineer, Maj. C. E. L. B. Davis, Corps of Engineers, and reports thereon submitted through the Division Engineer, Col. William P. Craighill, Corps of Engineers:

1. Preliminary examination of Chapel Point Harbor, Maryland, at the junction of the Potomac and Port Tobacco rivers.—Major Davis submitted report of examination December 13, 1894. He does not regard the locality as worthy of improvement by the General Government, and his views are concurred in by the division engineer and by this office. The report was transmitted to Congress and printed in House Ex. Doc. No. 135, Fifty-third Congress, third session. (See also Appendix I 12.)

2. Preliminary examination of Quantico Creek, Virginia.—Major Davis submitted report of examination December 17, 1894. It is his opinion and that of the division engineer, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 153, Fifty-third Congress, third session. (See also Appendix I 13.)

3. Preliminary examination of Great Wicomico River, Virginia, from Cedar Point to Indian Point.—Major Davis submitted report of examination December 4, 1894. It is his opinion and that of the division

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engineer, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 105, Fifty-third Congress, third session. (See also Appendix I 14.)

4. Preliminary examination of Little Wicomico River, Virginia, at its mouth.—Major Davis submitted report of examination November 26, 1894. In his opinion, concurred in by the division engineer and by this office, this locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 24, Fifty-third Congress, third session. (See also Appendix I 15.)

5. Preliminary examination of Jacksons Creek near mouth of Piankatank River, Virginia.—Major Davis submitted report of examination November 27, 1894. It is his opinion and that of the division engineer, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 26, Fifty-third Congress, third session. (See also Appendix I 16.)

6. Preliminary examination of Ware River, Virginia.—Major Davis submitted report of examination December 18, 1894. It is his opinion, concurred in by the division engineer and by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 152, Fifty-third Congress, third session. (See also Appendix I 17.)

7. Preliminary examination of Harris Creek Prong of Back River, Virginia.—Major Davis submitted report of examination December 26, 1894. He is of opinion that this stream is worthy of improvement by the General Government, and his views are concurred in by the division engineer and by this office. It is estimated that the survey necessary to submit plan and estimate for the improvement will cost $400. The report was transmitted to Congress and printed in House Ex. Doc. No. 175, Fifty-third Congress, third session. (See also Appendix I 18.)

8. Survey of bar at the northwest entrance of Milford Haven from Piankatank River, Virginia.—Major Davis submitted report of survey January 31, 1895. He recommends improvement of the entrance by dredging, at an estimated cost of $12,500. The report was transmitted to Congress and printed in House Ex. Doc. No. 299, Fifty-third Congress, third session. (See also Appendix I 19.)

9. Survey of mouth of Cranes Creek, Virginia.—Major Davis submitted report of survey February 11, 1895. He presents a plan for improvement by dredging a channel 9 feet deep and 150 feet wide through Bussels Point, substantially where there was 10 feet of water in 1869, which, together with needed protecting jetties, is estimated to cost $56,040, the dredged material to be deposited so as to close the present mouth. He also submits an alternate plan of improvement, which contemplates utilizing the existing deep water at the present mouth of the creek and dredging a channel on a southeasterly line to connect with the natural channel on the outside of Bussels Point, the dredged channel to be continued through the bar on the inside. The improvement is estimated to cost $29,160. An examination of this creek was made in 1891, and it was then reported as not worthy of improvement by the General Government. (Report of the Chief of Engineers, 1891, Part II, p. 1289). For reasons stated, Major Davis does not now recommend the work, and Colonel Craighill in forwarding the report remarks that "it seems clear that this is not a case justifying the expenditure of money from the Treasury of the United States. The improvement is therefore not recommended." The report was transmitted to Congress

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and printed in House Ex. Doc. No. 320, Fifty-third Congress, third session. (See also Appendix I 20.)

IMPROVEMENT OF RIVERS AND HARBORS IN SOUTHEASTERN VIRGINIA AND NORTHEASTERN NORTH CAROLINA.

This district was in the charge of Capt. Edward Burr, Corps of Engineers, to November 1, 1894, and of Capt. T. L. Casey, Corps of Engineers, since that date; Division Engineers, Col. William P. Craighill, Corps of Engineers, to May 18, 1895, and Lieut. Col. Peter C. Hains, Corps of Engineers, since that date.

1. Harbor at Norfolk and its approaches, Virginia.—In 1877, before the present improvement was begun, the harbor of Norfolk was obstructed by shoals at the mouths of the Eastern and Southern branches, the shoal in the Eastern Branch being about one-third of a mile long, with a low-water depth of 15 to 16 feet; that in the Southern Branch being short and with a depth of 22 to 23 feet.

The approaches to the harbor were obstructed by shoals at Sewall Point 3 miles long, with a low-water depth of 20 feet, and at the mouth of the Western Branch 1 mile long, with a low-water depth of 19 feet.

The depths of these shoals and the widths of the channels, particularly in the inner harbor, where encroached upon by the Portsmouth and Berkley flats, were insufficient for the requirements of the port.

The plan of improvement adopted in 1878 was to deepen and widen the channels at the mouth of the Southern Branch and along Portsmouth and Berkley flats in the harbor proper, and to improve the approaches to the harbor by dredging a channel 500 feet wide and 25 feet deep at ordinary low water through the shoals at Sewall Point and at the mouth of the Western Branch.

The revised project of 1885 is as follows: (1) To dredge a channel not less than 500 feet wide and 25 feet deep at ordinary low water from the deep water in Hampton Roads to Norfolk and the United States navy-yard on the Southern Branch, and also to dredge a channel in the Eastern Branch not less than 22 feet deep at ordinary low water, with a width of 700 feet at its mouth and of not less than 300 feet at the Norfolk and Western Railroad bridge; (2) to ultimately dredge the entire area bounded by lines parallel to and 75 feet from the portwarden lines to a depth not less than 25 feet from Fort Norfolk to the United States navy-yard, and not less than 22 feet from the mouth of the Eastern Branch to Campostella bridge, and to build a bulkhead at Berkley Flats.

To the project of 1885 there was added in 1890 the dredging of an anchorage at the mouth of the Western Branch, with a depth of not less than 25 feet at ordinary low water, at an estimated cost of $150,000, which amount was added to the original estimate.

The amount expended on this improvement to June 30, 1894, was $782,027.81, from which resulted a channel not less than 500 feet wide and 25 feet deep at ordinary low water from Hampton Roads to Norfolk Harbor, a channel of the same depth and from 400 to 650 feet wide in the Southern Branch to the United States navy-yard, a channel not less than 22 feet deep at ordinary low water and from 500 to 1,050 feet wide in the Eastern Branch to the Norfolk and Western Railroad bridge, and the dredging of 58½ acres of the anchorage to the required depth, 17 acres requiring no dredging being also made available.

The channels thus dredged were in good condition, with the exception of the bars at Sewall Point and Lambert Point. Examinations made in August, 1893, show shoal spots having from 23½ to 24 feet on

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the former and considerable shoaling on the eastern side of the dredged channel through the latter.

The amount expended during the fiscal year is $34,190.37. With this amount the channel between Hospital Point and the mouth of the Southern Branch of Elizabeth River was widened 175 feet for a distance of 2,650 feet, the channel between Hospital and Pinner points widened 37 feet for a distance of 2,351 feet, and a cut 40 feet wide made through the center of the channel over Sewall Point Bar for a distance of 7,800 feet.

The amount of material removed during the fiscal year is 381,515 cubic yards, the work being done under a contract at 9 cents per cubic yard, scow measurement. Work under this contract will be continued during the fiscal year 1896 until the available funds are exhausted.

The commerce of the harbor during the calendar year 1894 is reported to be 4,545,049 tons, against 3,584,727 tons in 1893.

July 1, 1894, balance unexpended		$3,039.69
Amount appropriated by act of August 17, 1894		100,000.00
		103,039.69
June 30, 1895, amount expended during fiscal year		34,190.37
July 1, 1895, balance unexpended		68,849.32
July 1, 1895, outstanding liabilities	$5,512.32	
July 1, 1895, amount covered by uncompleted contracts	59,130.75	
		64,643.07
July 1, 1895, balance available		4,206.25
Amount (estimated) required for completion of existing project		156,744.56
Amount that can be profitably expended in fiscal year ending June 30, 1897		100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix J 1.)

2. Approach to Norfolk Harbor and the United States (Norfolk) navy-yard between Lambert Point and Fort Norfolk, Virginia.—In its original condition this portion of the approach to Norfolk Harbor was obstructed by a shoal at the mouth of the Western Branch about 1 mile long with a depth of 19 feet at ordinary low water.

The project of 1878 was to dredge through this shoal a channel 500 feet wide with a depth of not less than 25 feet at ordinary low water.

The revised project of 1886 is (1) to secure a channel not less than 500 feet wide and 25 feet deep at ordinary low water from Lambert Point to Fort Norfolk by the construction of a dike and by dredging, and (2) to ultimately widen this channel to within 75 feet of a straight line drawn from Fort Norfolk to the deep water off Lambert Point, 6,800 feet of which is the proposed port-warden line, making the channel at least 700 feet wide.

The amount expended on this improvement between July 5, 1884, and June 30, 1894, was $197,593.75, from which resulted a channel between Lambert Point and Fort Norfolk 700 feet wide and 25 feet deep at ordinary low water and a channel of the same depth and 600 feet wide from deep water off Lambert Point to the port-warden line.

There were no expenditures during the fiscal year ended June 30, 1895, for this improvement.

The project of 1886 has been completed with the exception of the dike. The survey of 1889 and examinations of April, 1890, and May, 1891, did not show any shoaling of the dredged channel. A survey made in May, 1892, showed a shoaling on the eastern side of the channel, thought not to be due to natural causes, and a resurvey in August, 1892, shows a further shoaling and partially confirms this view. It is not thought that the proposed dike will be necessary for the maintenance of this

channel. To maintain the projected depth redredging of a portion of the channel will soon be necessary, but it can be provided for out of the funds for improving the harbor at Norfolk and its approaches, Virginia, and no further appropriation will be required for this project at present.

(See Appendix J 2.)

3. Nansemond River, Virginia.—This river is one of the important tributaries of Hampton Roads, Virginia, and is navigable at high water for vessels drawing 11 feet as far as the city of Suffolk, 16 miles from its mouth.

Five railroads, two of which terminate at this place, put this city in communication with the South and West, and two lines of steamers run between it and Norfolk and Baltimore.

In 1872, before any improvement was undertaken, the navigable channel of the Nansemond River was 5 feet deep at low water, and was much obstructed by wrecks, snags, etc.

Between 1873 and 1878 the Government dredged the channel, wherever necessary, 8 feet deep at low water, from Suffolk to Hampton Roads, at a cost of $37,000. This depth not being sufficient to meet the demands of its growing commerce, in obedience to the requirements of the river and harbor act of August 5, 1886, an examination and survey of the river were made to determine what other improvement was necessary.

The plan of improvement then proposed and since adopted is to secure a channel not less than 100 feet wide at bottom, 12 feet deep at mean low water from the head of navigation to the mouth of the Western Branch, 5.37 miles, including a turning basin 200 feet square 300 feet below Suffolk bridge, by dredging and by the construction of spurs and training walls, and a channel of like depth from the mouth of the Western Branch to deep water at Town Point 200 feet wide at bottom at its upper end and gradually increasing to at least 400 feet at its lower end, etc., the total estimated cost being, in round numbers, $152,500.

The amount expended on the present project to June 30, 1894, was $29,994.22, which was applied to dredging a channel 80 feet wide and 12 feet deep at ordinary low water through Suffolk Shoal and five other shoals between Suffolk and a point 3½ miles below. A survey made in September, 1893, shows the dredged channel to be generally in good condition. It also shows other shoals requiring dredging before the construction of the works of permanent improvement can be commenced.

The amount expended on this improvement during the fiscal year ended June 30, 1895, is $10,005.78. With this amount channels 2,100 feet long, 80 feet wide, and 12 feet deep at mean low water were dredged through the shoal at the Western Branch Dike and a shoal below the mouth of the Western Branch. In doing this work, 48,220 cubic yards of material was excavated and deposited on the flats in Hampton Roads to the westward of the mouth of the river, under contract. The price paid the contractor was 18½ cents per cubic yard, scow measurement.

A survey of Nandua Creek was also made, as provided for under the recent appropriation for this improvement, $337.18 of the above amount being expended in making the survey. The report of the results of this survey is submitted herewith as Appendix J 16.

The commerce of this river during the calendar year 1894 is reported to be 53,762 tons, being 5,711 tons less than that given for the calendar year 1893.

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July 1, 1894, balance unexpended	$5.78
Amount appropriated by act of August 17, 1894	10,000.00
	10,005.78
June 30, 1895, amount expended during fiscal year	10,005.78
Amount (estimated) required for completion of existing project	112,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix J 3.)

4. Chickahominy River, Virginia.—This river is one of the principal tributaries of the James River, and is navigable at high water for vessels drawing 12 feet to Binn Bar, 2½ miles below Windsor Shades. The latter place is the head of navigation, and is 25 miles from the mouth of the river.

Previous to any improvement the channel from Binn Bar to Windsor Shades was obstructed by several shoals, with a depth of 4 to 5 feet at low water, and the entrance to the river was obstructed by a bar.

The present project of improvement is to dredge a channel from 100 to 150 feet wide, and not less than 8 feet deep at low water, through the shoals near the head of navigation, and a channel 200 feet wide and 14 to 15 feet deep at low water through the bar at the entrance. The rise of the tide is about 3 feet.

The amount expended on the present project to June 30, 1894, was $23,829.91. The channel through the bar at the entrance to the river has been dredged to the projected dimensions. The channel through the shoals between Binn Bar and Windsor Shades has been dredged to not less than 8 feet deep at low water, and to a width of 60 feet, excepting a part of Windsor Shades Bar, where the width is 40 feet.

Five thousand dollars was appropriated for this improvement by act of July 13, 1892, and a contract was made to do the required dredging at 23 cents per cubic yard for material deposited on shore and 13 cents per cubic yard for material deposited from scows. The work under this contract, which was commenced June 9, 1894, was continued during the present fiscal year until July 29, 1894, 18,188 cubic yards of material being removed during July. Thirty-five thousand six hundred and thirty-four cubic yards was removed under the contract and deposited from scows, and resulted in a channel through Upper and Lower Binn, Osborn, Old Fort, and Windsor Shades Bars, 100 feet wide and 9 feet deep at low water, the aggregate length of the channel dredged being 5,875 feet.

A channel 100 feet wide and 8 feet deep has been dredged from the mouth to the head of navigation, thus completing the project. This channel, which was found to be in good condition after the completion of dredging in July, 1894, is considered sufficient to accommodate the traffic of this stream, and no further appropriation is necessary.

The commerce of this stream for the calendar year 1894 is reported to be 25,250 tons, valued at $179,000. The value of the commerce for the calendar year 1893 was stated to be $320,000.

July 1, 1894, balance unexpended	$5,170.09
June 30, 1895, amount expended during fiscal year	5,170.09

(See Appendix J 4.)

5. Appomattox River, Virginia.—This river is one of the principal tributaries of the James River, into which it empties at City Point, Va. It is navigable as far as the city of Petersburg, about 11 miles from its mouth, and before improvement had a tortuous channel obstructed by shoals, over which there was about 6½ feet of water at high tide.

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The project for this improvement was adopted in 1870, and provided for a channel 60 feet wide at the bottom and 12 feet deep at mean high water. As subsequently modified, the project is to provide a channel from Petersburg to natural deep water at Point of Rocks, 80 feet wide at the bottom and 12 feet deep at mean high water, by dredging, by constructing regulating and contracting works, and by making a cut-off called Puddledock Cut. With slight modifications of details all operations have been conducted in accordance with this project.

This stream is subject irregularly to freshets, by which large quantities of sand are brought down and deposited in the navigable portion of the river. The currents at ordinary stages have not sufficient power to remove the shoals thus formed. The sums appropriated for this improvement have for many years been but little in excess of the amount required for the repairs to the channel and the works already constructed. The completion of the permanent improvement of the river has consequently dragged beyond all reason, and the apparent cost of the improvement has been much in excess of the original estimates, while the actual amount expended in accordance with these estimates has been but a small proportion of the total expenditures.

The amount expended by the United States on this improvement to June 30, 1894, was $421,921.94.

By 1875 a channel 60 feet wide and 12 feet deep at mean high water had been secured from Petersburg to Point of Rocks by dredging such shoals as required it and by making a cut-off called Puddledock Cut. This channel was subsequently increased in width to 80 feet, and has been maintained with a depth of 11 to 12 feet as constantly as possible by redredging shoals formed by freshets and by constructing contracting and regulating works.

The amount expended during the fiscal year ended June 30, 1895, is $2,628.71. With this amount a cut 60 feet wide was dredged below the Closure Dike for a distance of 950 feet, 7,200 cubic yards of material being removed, all of which was placed behind the Closure Dike dam to strengthen it. The work was done by hired labor, the hire of the dredge belonging to the city of Petersburg and the use of the tugboat and scows belonging to this improvement, and cost 18 cents per cubic yard.

The freshets of the past winter and spring have caused shoals to form in the river, the most serious one being below Gatling's wharf, and at the close of the fiscal year arrangements had been made to remove it by hired labor and the use of the tugboat and scows belonging to the improvement. Operations will be begun early in July.

No information as to the commerce of this stream during the calendar year 1894 could be obtained. For the calendar year 1892 it was given as 25,218 tons.

July 1, 1894, balance unexpended	$2,002.56
Amount appropriated by act of August 17, 1894	5,000.00
	7,002.56
June 30, 1895, amount expended during fiscal year	2,628.71
July 1, 1895, balance unexpended	4,373.85
July 1, 1895, outstanding liabilities	185.00
July 1, 1895, balance available	4,188.85

Amount (estimated) required for completion of existing project	48,090.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	2,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix J 5.)

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6. Inland water route from Norfolk Harbor, Virginia, to Albemarle Sound, North Carolina, through Currituck Sound.—This is one of the most important links in the chain of inland water communication along the Atlantic Coast.

It connects Chesapeake Bay with Albemarle Sound, and is composed of the following bodies of water, viz: Elizabeth River, North Landing River, Currituck Sound, Coanjock Bay, North River, and the Albemarle and Chesapeake Canal. With the exception of the canal, which was constructed and is maintained by private enterprise, all are natural waterways.

Before any improvement was undertaken by the Government there was over this route an indifferent channel 5 to 7 feet deep at low water, the navigation of which was obstructed by overhanging growth, snags, and sharp bends in all the rivers.

The project adopted was to secure a channel 80 feet wide and 9 feet deep at low water over the entire route, about 58 miles, by dredging, by removing obstructions, and by constructing a dike.

The waterways mentioned above were under separate improvement until September 19, 1890, when an appropriation was made to embrace them all. Previous to this an aggregate of $238,656.88 had been expended upon the separate works, and resulted in a channel 25 to 80 feet wide and 8 to 9 feet deep throughout the entire route.

Since the date of consolidation $18,973.49 had been expended to June 30, 1894, resulting in the removal of nine shoals in the Elizabeth River to a depth of 9 feet at low water and a channel width of 50 feet, a channel 600 feet long and 25 feet wide through another shoal, a channel 80 feet wide in North River from the southern end of the North Carolina Cut of the Albemarle and Chesapeake Canal to a point 2,000 feet southward from Beacon No. 9, and a channel 70 feet wide in Currituck Sound between Beacons Nos. 5 and 6, the depth in each instance being 9 feet at low water.

The amount expended during the fiscal year ended June 30, 1895, is $4,824.46, which resulted in a width of 80 feet to the channel between Long Point Wharf and Church Island, Coanjock Bay, for a distance of 3,800 feet, and 20 feet for a farther distance of 1,350 feet, with 9 feet depth at mean low tide. In doing this 38,812 cubic yards of material was removed at 13½ cents per cubic yard under a contract. In addition a survey was made of portions of this route at a cost of $1,200.

The commerce of this route during the calendar year 1894 is reported to be 285,455 tons, valued at $4,792,559.

July 1, 1894, balance unexpended		*$26.51
Amount appropriated by act of August 17, 1894		10,000.00
		10,026.51
June 30, 1895, amount expended during fiscal year		4,824.46
July 1, 1895, balance unexpended		5,202.05
July 1, 1895, outstanding liabilities	$1,533.40	
July 1, 1895, amount covered by uncompleted contracts	2,359.53	
		3,892.93
July 1, 1895, balance available		1,309.12
Amount (estimated) required for completion of existing project		39,667.08
Amount that can be profitably expended in fiscal year ending June 30, 1897		5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix J 6.)

*Amount expended during fiscal year 1894 was $9,673.23, and not $9,623.23, as reported; therefore balance unexpended July 1, 1894, was $26.51.

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7. North Landing River, Virginia and North Carolina.—This river forms a part of the "inland water route from Norfolk Harbor, Virginia, to Albemarle Sound, North Carolina."

Before its improvement the navigation of this river was obstructed by shoals, over which the depth was 6 feet at low water, by snags, and by sharp bends.

The plan of improvement, adopted in 1879, was to secure a channel 80 feet wide and 9 feet deep at low water by dredging shoals and removing bends and obstructions.

This project was completed June 30, 1884, at a cost of $49,777.34, and the desired channel obtained over a distance of 17 miles. Since that time $6,379.54 has been expended on this river in removing sunken logs which have become detached from passing rafts, making a total expenditure on this improvement to June 30, 1894, of $56,156.88.

The river was last cleared of sunken logs in August and September, 1892, these obstructions having by that time become troublesome to navigation.

The method adopted for rafting logs in these waters is very faulty, resulting in a considerable loss of logs to the owners and the material obstruction to navigation on this river and the connecting portions of the "inland water route," by decreasing the available navigable depth by at least 1 foot, and by remaining a menace to the hulls and propellers of passing vessels.

These sunken logs are now the controlling element of the available depth in these streams; and the desirability of doing any further dredging while the rafting business is carried on under the present system is questionable.

The expenditures during the fiscal year amounted to $4.65 for office expenses. There is still a small balance available for the continuance of operations, and no further appropriation for this work is necessary.

July 1, 1894, balance unexpended	$1,512.81
June 30, 1895, amount expended during fiscal year	4.65
July 1, 1895, balance unexpended	1,508.16

(See Appendix J 7.)

8. Roanoke River, North Carolina.—[This work was in the charge of Maj. W. S. Stanton, Corps of Engineers, until January 15, 1895.] When the United States commenced this improvement, 1872, navigation by vessels of 10 feet draft was embarrassed by the wreck of a gunboat 6 miles above the mouth of the river and by war obstructions at two other points 9 and 13 miles above its mouth. The river was also somewhat obstructed for that draft by snags in the channel, and by leaning trees 67 miles to Indian Highland Bar; thence 62 miles up to Weldon its channel depth on the bars was not less than about 5 feet during about 8 months annually, affording a continuous low-water navigation of not more than 2 or 3 feet, and its channel was badly obstructed by snags, logs, stumps, and leaning and overhanging trees.

The original project of 1872 is to secure at all seasons of the year an unobstructed channel with a least width of 50 feet from the mouth 129 miles to Weldon, with a low-water depth of 5 feet from Hamilton 67 miles to Weldon, and to clear the natural channel of snags and artificial obstructions from the mouth 62 miles to Hamilton to the depth requisite for vessels navigating the North Carolina sounds, which draw not more than 8 feet, by removing the war obstructions, snags, fallen and overhanging trees, sand bars, and ledges, by dredging, the construction of training dikes, and blasting, at an estimated cost, at the high prices of that time, of $269,000.

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To June 30, 1894, $158,246.11 had been expended on this improvement. At that date the natural channel depth was not less than 10 feet from the mouth 67 miles to Indian Highland Bar at extreme low water, and was, at ordinary low water, not less than 5 feet thence 62 miles to Weldon, except upon sand bars 150 feet long at Spring Gut 21 miles above Hamilton, about 1,600 feet long at Halifax 57 miles above Hamilton, and about 800 feet long 1¼ miles below Weldon, and upon a ledge of rock about 2,800 feet in length, extending from old Weldon Ferry up to old Weldon Landing, the depth at these four localities being about 4 feet at ordinary low water, assumed at the zero of the Weldon gauge.

From a point about 8 miles below Hamilton at intervals down about 21 miles to Cades Eddy, 33 miles above the mouth, the removal of snags from the channel and the clearing of the banks at bends was requisite; otherwise the river was in good navigable condition.

The expenditures during the fiscal year ended June 30, 1895, amounted to $7,679.81, resulting in the removal of 207 large snags, 100 stumps, and 148 trees from the channel and banks between the eighty-ninth and one hundred and third mile posts, and in the formation of a cut 90 feet wide at the upper end and 70 feet wide at the lower end and 5 feet deep at extreme low water, through the point of land forming Shad Island Bend, 31,250 cubic yards of material being removed at 16 cents per cubic yard under a contract.

A contract for building a snag boat for this improvement was entered into May 20, 1895, the contract price being $15,424.

July 1, 1894, balance unexpended		$31,055.00
Amount appropriated by act of August 17, 1894		30,000.00
Amount received from sale of property to other works		1,338.00
		62,393.00
June 30, 1895, amount expended during fiscal year		7,679.81
July 1, 1895, balance unexpended		54,713.19
July 1, 1895, outstanding liabilities	$275.00	
July 1, 1895, amount covered by uncompleted contracts	15,322.02	
		15,597.02
July 1, 1895, balance available		39,116.17
Amount (estimated) required for completion of existing project		51,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix J 8.)

9. Pasquotank River, North Carolina.—[This work was in the charge of Maj. W. S. Stanton, Corps of Engineers, until January 15, 1895.] When the United States began this improvement, in 1891, the river had a wide channel, nowhere less than 9½ feet deep in calm weather and 8 feet in northerly winds, from Albemarle Sound up 17 miles to Elizabeth City, and a narrower but good channel, but little obstructed, not less than 7 feet deep 13 miles farther up, to the entrance to the Dismal Swamp Canal at the lower end of Turners Cut; thence about 5 miles to the original terminus of the canal and upper end of Turners Cut in a tributary, the Moccasin Track, 1,100 feet above its confluence with the river, the natural depth was not less than 5 feet, the channel very sinuous, and badly choked with snags and stumps, and obstructed by overhanging trees, and above the Moccasin Track the river was likewise choked and obstructed.

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The original project of 1889 was first to clear the 5 miles of channel in the river and Moccasin Track from the lower end of Turners Cut to the original terminus of the canal, to permit boats passing through the canal to avoid Turners Cut, which had shoaled; and, second, to clear out the river 6 miles farther to Lebanon bridge, for navigation by pole or flat boats, at an estimated cost of $9,000.

By letter of August 3, 1892, the Chief of Engineers authorized the application of $3,000, appropriated by act of July 13, 1892, to be restricted to the removal of such obstructions from the channel below the lower mouth of Turners Cut as interfere with boats of the draft (about 3 feet) that can be carried through the canal, since as great a draft can be carried through Turners Cut, and because boats traversing the canal continued to use Turners Cut in preference to the sinuous and longer route in the river and Moccasin Track, where a practicable channel had been cleared for them in 1891, and because of the very small amount of commerce, merely by flat or pole boats, in the river above.

The sum of $4,507.15 had been expended to June 30, 1894.

At that date, for boats of the draft that can navigate the canal, the river channel was unobstructed up to the entrance of the canal at the lower mouth of Turners Cut.

No work has been done upon the river during the fiscal year ended June 30, 1895. The expenditures amounted to $61.15 for office expenses.

July 1, 1894, balance unexpended	$1,498.85
Amount appropriated by act of August 17, 1894	1,000.00
	2,498.85
June 30, 1895, amount expended during fiscal year	61.15
July 1, 1895, balance unexpended	2,437.70

(See Appendix J 9.)

10. Mackeys Creek, North Carolina.—[This work was in charge of Maj. W. S. Stanton, Corps of Engineers, until January 15, 1895.] When the United States began to improve it in 1892 the depth was only 7 feet in the somewhat circuitous channel on the shoal at the mouth of the creek in Albemarle Sound.

The project of 1889 was to dredge a straight channel 9 feet deep, 100 feet wide, and about 2,100 feet long through the shoal, modified in May, 1892, by increasing the width of the channel to 140 feet.

To June 30, 1894, $14,640.10 had been expended upon this improvement, and a channel 2,200 feet long, 140 feet wide, and 9 feet deep had been dredged through the shoal in completion of the project.

During the fiscal year ended June 30, 1895, $68.19 was expended for office expenses.

July 1, 1894, balance unexpended	$464.49
June 30, 1895, amount expended during fiscal year	68.19
July 1, 1895, balance unexpended	396.30

(See Appendix J 10.)

11. Removing sunken vessels or craft obstructing or endangering navigation.—The schooner *Briton M. Tilton*, sunk in from 3 to 7 feet of water at low tide in the mouth of Smiths Creek, Virginia, was reported an obstruction to navigation and its removal was authorized.

The work of removing this wreck was commenced April 17, 1895, and finished April 27, 1895; the cost of the removal was $290.

(See Appendix J 11.)

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12. Survey of waterways connecting Dismal Swamp Canal, Virginia, with the sounds of North Carolina.—This survey, provided for by the river and harbor act of August 17, 1894, had not been begun at the close of the fiscal year, but preparations are being made to commence it early in the fiscal year 1896.

Amount appropriated by act of August 17, 1894	$5,000.00
June 30, 1895, amount expended during fiscal year	74.01
July 1, 1895, balance unexpended	4,925.99

(See Appendix J 12.)

EXAMINATIONS AND SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations and survey of the following localities, required by the act of August 17, 1894, were made by the local engineer, Capt. T. L. Casey, Corps of Engineers, and reports thereon submitted through the division engineer:

1. Preliminary examination of Lyons Creek, Virginia.—Captain Casey submitted report of examination December 14, 1894. He is of opinion that this creek is not worthy of improvement by the General Government, and his views are concurred in by the division engineer, Col. William P. Craighill, Corps of Engineers, and by this office. The report was transmitted to Congress and printed in House Ex. Doc. No. 139, Fifty-third Congress, third session. (See also Appendix J 13.)

2. Preliminary examination of Deep Creek Branch of Elizabeth River, Virginia, with a view of obtaining a depth equal to that of the Lake Drummond Canal, formerly the Dismal Swamp Canal.—Captain Casey submitted report of examination December 17, 1894. It is his opinion, concurred in by the division engineer and by this office, that the channel of Deep Creek is not at present worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 154, Fifty-third Congress, third session. (See also Appendix J 14.)

3. Preliminary examination of Western Branch of Elizabeth River, Virginia.—Captain Casey submitted report of examination January 12, 1895. It is his opinion and that of the division engineer, concurred in by this office, that the locality is worthy of improvement by the General Government. The necessary maps upon which to base an estimate of cost of the improvement are on file in the office of the local engineer. The report was transmitted to Congress and printed in House Ex. Doc. No. 218, Fifty-third Congress, third session. (See also Appendix J 15.)

4. Survey of Nandua Creek, Virginia.—The river and harbor act of August 17, 1894, in the item making an appropriation for improving Nansemond River, Virginia, provides for a survey with estimate for the improvement of Nandua Creek.

Captain Casey, under date of June 17, 1895, submits his report of the results of the survey thus provided for, in which he states that the depths within the bar are ample at present for all commercial needs, and a straight channel 100 feet wide and 8 feet deep at mean low water across the bar is the only relief now sought. Such a channel he estimates may be dredged at a cost of $6,000, but he states that this channel would certainly not prove permanent.

A preliminary examination of this creek was made to comply with provisions of the river and harbor act of September 19, 1890, and the report of the results of that examination was submitted to Congress and printed in House Ex. Doc. No. 290, Fifty-first Congress, second

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session. (See also Annual Report of the Chief of Engineers, 1891, Part II, pp. 1283–1285.) It was then stated that the locality was not worthy of improvement by the General Government.

Captain Casey's report of the recent survey is submitted herewith. (See Appendix J 16.)

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN NORTH CAROLINA AND SOUTH CAROLINA.

This district was in the charge of Maj. W. S. Stanton, Corps of Engineers, with Lieut. E. W. Van C. Lucas, Corps of Engineers, under his immediate orders; Division Engineers, Col. William P. Craighill, Corps of Engineers, to May 18, 1895, and Lieut. Col. Peter C. Hains, Corps of Engineers, since that date.

1. Ocracoke Inlet, North Carolina.—In 1828 vessels drawing 9 feet could cross the ocean bar and enter the inlet at low water, but immediately within the inlet their passage to Pamlico Sound was barred by the inner shoals, over which not more than 5 feet could be carried.

For the improvement of these inner shoals the project of 1827 was to dredge a cut 10 feet deep at high water and 400 feet wide at the head of Wallace Channel. Dredging was commenced in 1830, and the depth was increased 3½ feet by the expenditure of $133,732.40 to 1837, when the improvement was abandoned because of the shoaling of the dredged channel and destruction by a gale of a jetty built to prevent that shoaling.

May 14, 1894, the project was modified to dredge Teachs Hole Swash Channel to the depth of 9 feet and width of 400 feet, at an estimated cost of $29,339.38; or, if that channel shoal so rapidly as to make its abandonment advisable, to dredge a cut 9 feet deep and 300 feet wide at the head of Blairs Channel, at an estimated cost of $28,000.

To June 30, 1894, $10,020.41 had been expended.

At that date surveys had been made during three seasons, 1891, 1892, and 1893, embracing a large area of the shoals, and current and tidal observations in the three principal channels whose depth and condition remained unchanged.

July 9, 1894, the project was again modified to dredge cuts 9 feet deep at mean low water and 300 feet wide, about 5,000 feet long at the the head of Wallace Channel and about 700 feet long in Beacon Island Slue, at an estimated cost of $51,513.39, to obtain a channel 9 feet deep from the inlet through the inner shoals to Pamlico Sound.

With the amount applied during the fiscal year ending June 30, 1895, a cut had been dredged at the head of Wallace Channel 1,945 feet long and 120 feet wide, 115 feet long and 90 feet wide, 235 feet long and 60 feet wide, and 25 feet long and 30 feet wide, to the depth of 9 feet at mean low water.

July 1, 1894, balance unexpended		$95,012.27
June 30, 1895, amount expended during fiscal year		3,931.18
July 1, 1895, balance unexpended		91,081.09
July 1, 1895, outstanding liabilities	$4,473.62	
July 1, 1895, amount covered by uncompleted contracts	62,991.29	
		67,464.91
July 1, 1895, balance available		23,616.18

(See Appendix K 1.)

2. Fishing Creek, North Carolina.—From its confluence with the Tar River, 94 miles above Pamlico Sound, for about 50 miles up to Bellamys Mill, Fishing Creek averages about 75 to 100 feet wide and has a

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channel of good, practicable width for small steamboats. September 19, 1890, when the first appropriation was made for its improvement, the controlling channel depth on its bars was 3 feet at the average high-water stage of winter and spring. From its mouth about 17 miles to Savages bridge the channel was more or less obstructed by submerged snags; for the lower and greater part of the 25 miles thence to the vicinity of the Wilmington and Weldon Railroad bridge it was obstructed by many submerged snags and by large masses of trees and logs, forming in many places dense barricades spanning the creek and making its descent slow and tedious in a skiff.

From the railroad bridge about eight miles up to Bellamys Mill the channel was impracticable on account of its sinuous character around a short ledge of rock, masses of rock projecting from the concave bank at six sharp bends, many leaning trees, and more or less submerged snags. In summer the channel depth is but a few inches.

The project of 1889 is "to clear out its natural obstructions from its mouth up to Bellamys Mill, at a total expense of about $25,000."

No money has been expended upon its improvement to June 30, 1895, as the benefit to navigation resulting from improvement of the creek would be very restricted and not commensurate with the cost, and the subject was reported to Congress on pages 1377 to 1380 of the Annual Report of the Chief of Engineers for 1893, for its further instructions, which are still awaited.

July 1, 1894, balance unexpended	$15,000.00
July 1, 1895, balance unexpended	15,000.00
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	10,000.00

(See Appendix K 2.)

3. Pamlico and Tar Rivers, North Carolina.—(One river, called the Pamlico below and the Tar above Washington.) When the United States began to improve it, in 1877, its channel was obstructed in two places below Washington by piles; just below Sparta by scuttled lighters; 1 mile below Tarboro by the wreck of a steamer; immediately below Washington by a bar with a depth of 5 feet at low water on its crest in the channel. Between Washington and Tarboro the available depth exceeded 2 to 3 feet not more than eight months annually, and above Washington the entire river was more or less obstructed by snags, logs, and stumps in the channel and by trees overhanging from its banks.

The project is that adopted in 1875 to secure by dredging and removal of war obstructions a clear and safe channel, 9 feet deep at low water, up to Washington, extended in 1879 to clear a channel 60 feet wide, 3 feet deep at low water, 22 miles farther to Greenville, and 20 inches deep at low water 26 miles farther to Tarboro; again extended in 1889 to clear the river to its natural dimensions 40 miles farther to Little Fall, 2 miles below Rocky Mount, by removal of war obstructions, snags, logs, stumps, and overhanging trees, at a total final cost estimated in 1891 at $137,200.

To June 30, 1894, $87,474.83 had been expended upon this work.

At that date there was an unobstructed channel, 8 feet deep at ordinary stages, from the mouth up 39 miles to Washington, whence, 22 miles to Greenville, the channel prescribed in the project had been obtained, while from Greenville 26 miles to Tarboro the obtaining and maintenance of the depth of 20 inches prescribed in the project was uncertain, owing to the changes continually occurring in the shoals.

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From Tarboro up 40 miles to Little Falls the channel had been twice cleared of snags, but the only navigation was by one small steam flat-boat, running principally as a tender to an oil mill 3 miles above Tarboro.

The amount applied during the fiscal year ending June 30, 1895, has been for the maintenance of plant only, and no work has been done upon the river owing to the high stage of water.

July 1, 1894, balance unexpended	$644.21
Amount appropriated by act of August 17, 1894	10,000.00
	10,644.21
June 30, 1895, amount expended during fiscal year	1,067.97
July 1, 1895, balance unexpended	9,576.24
July 1, 1895, outstanding liabilities	49.47
July 1, 1895, balance available	9,526.77
Amount (estimated) required for completion of existing project	39,200.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix K 3.)

4. Contentnia Creek, North Carolina.—When the United States began to improve it, in 1881, it was badly choked with fallen timber, snags, logs, and stumps; also obstructed by sand bars, and navigation rendered exceedingly difficult, in many places next to impossible, by the dense overhanging growth.

The project of 1881 is, by clearing it of these obstructions, to obtain, from its confluence with the Neuse, 63 miles, to Stantonsburg, a depth of not less than 3 feet during the higher stages of about nine months' duration annually, at a cost, estimated in 1888, at $77,500.

To June 30, 1894, $58,318.44 had been expended upon this work.

At that date, so far as regards snags, logs, and overhanging obstructions, the creek was in good navigable condition for boats of the draft that could pass through Spring Slough, about 1 mile above the mouth, where the bed for about one-fourth of a mile consists of an interwoven mass of live roots of trees.

With the amount applied during the fiscal year ending June 30, 1895, the channel was again cleared of snags carried into it by storms and caving banks, and there were removed from the channel 411 snags, 369 logs, 107 stumps, and 218 trees, and from the banks 263 trees were cut and pulled back and 41 trees trimmed.

July 1, 1894, balance unexpended	$685.86
Amount appropriated by act of August 17, 1894	10,000.00
	10,685.86
June 30, 1895, amount expended during fiscal year	2,784.02
July 1, 1895, balance unexpended	7,901.84
July 1, 1895, outstanding liabilities	414.48
July 1, 1895, balance available	7,487.36
Amount (estimated) required for completion of existing project	8,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

(See Appendix K 4.)

5. Trent River, North Carolina.—When the United States began to improve it, in 1879, the river was comparatively free from obstructions from Newbern, 18 miles, to Pollocksville, between which points a draft

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of 6 feet could be carried at low water. Above Pollocksville it was obstructed by bars of sand and rock, and especially by great numbers of snags in the 11 miles from Lower Quaker bridge up to Trenton. One steamer ran regularly to Pollocksville and one occasionally 9 miles farther, to Lower Quaker bridge, above which point navigation was confined to flatboats and rafts.

The project of 1879 was to secure a channel 3 feet deep at low summer stage from Pollocksville to Trenton by removing all obstructions and dredging a cut 50 feet wide through the shoals at a cost estimated in 1887 at $59,000.

In 1889 the project was extended to remove obstructions to permit navigation by small steamboats 33 miles above Trenton and by pole boats 6½ miles farther, to Upper Quaker bridge, at an additional cost of $13,000, the two projects aggregating $72,000.

To June 30, 1894, $60,055.63 had been expended upon this work.

At that date the channel had been well cleared and several times well recleared of snags up to Trenton; a channel which had been dredged 50 feet wide and 3 feet deep through several shoals of sand in the 1¼ miles next below Trenton had shoaled and been partially redredged so that 2.3 feet could be carried up to Trenton at low water; the turning basin at Trenton had also been dredged, shoaled, and redredged.

The amount applied during the fiscal year ending June 30, 1895, has been for surveys, office expenses, and commencement of dredging.

July 1, 1894, balance unexpended	$712.74
Amount appropriated by act of August 17, 1894	4,000.00
	4,712.74
June 30, 1895, amount expended during fiscal year	1,048.66
July 1, 1895, balance unexpended	3,664.08
July 1, 1895, outstanding liabilities	416.05
July 1, 1895, balance available	3,248.03
Amount (estimated) required for completion of existing project	7,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	2,000.00

(See Appendix K 5.)

6. Neuse River, North Carolina.—When the United States began to improve it in 1878, the minimum channel depth during nine months annually was 9 feet from the mouth 40 miles up to Newbern, 4 feet thence 50 miles to Kinston, 3 feet 46 miles farther to Goldsboro, and 2 feet thence 53 miles to Smithfield. Between Newbern and Kinston there were long stretches of shoals, upon at least one of which the depth at low-water season was only about 18 inches. The channel was obstructed at two points below Newbern, and at two between Newbern and Kinston, by inclined iron-pointed spars and boxes or vessels or cribs filled with stones. From Contentnia Creek up 119 miles to Smithfield the river was badly obstructed by overhanging trees and by dense masses of logs and snags in the channel.

The project of 1871, as modified or extended in 1878, 1879, 1880, and 1883, was to remove the war obstructions, to clear the channel to Smithfield of all snags, logs, and overhanging trees, to contract the channelway by jetties so as to insure during the entire year an unobstructed 8-foot navigation to Newbern, a similar 4-foot navigation to Kinston, and during nine months annually a 3-foot navigation to Smithfield, at a total final estimated cost of $374,000.

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To June 30, 1895, $267,878.82 had been expended upon this work.

At that date there was a good navigable channel 8 feet deep to Newbern, but between Newbern and the mouth of the Contentnia, on seven shoals, aggregating about 1¼ miles of channel length, and between the mouth of the Contentnia and Kinston, at many short crossings, aggregating about 1½ miles in length, the depth was less than that prescribed in the project.

With the amount applied during the fiscal year ending June 30, 1895, the main piles had been driven for 4,050 linear feet of sheet-pile jetties and 220 feet of shore connections built on the four worst shoals between Newbern and the mouth of the Contentnia.

July 1, 1894, balance unexpended	$15,372.91
Amount appropriated by act of August 17, 1894	7,000.00
	22,372.91
June 30, 1895, amount expended during fiscal year	8,672.80
July 1, 1895, balance unexpended	13,700.11
July 1, 1895, outstanding liabilities	76.45
July 1, 1895, balance available	13,623.66
Amount (estimated) required for completion of existing project	84,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	7,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix K 6.)

7. *Inland waterway between Newbern and Beaufort, N. C.* (via Neuse and Clubfoot rivers, Clubfoot and Harlowe Canal, and Harlowe and Newport rivers to Beaufort Harbor).—When the United States began to improve it, in 1885, that part of the waterway, 18 miles in length, across the peninsula between the Neuse River and Bogue and Core sounds, embracing 15.5 miles of natural channel connected at the summit by the Clubfoot and Harlowe Canal, was navigated by boats 15 feet wide with a draft of 1 foot at low water and about 2½ feet at high water.

The project of 1884 is to obtain a channel 30 feet wide at bottom and 5 feet deep at mean low water across the peninsula, by dredging in Clubfoot, Newport, and Harlowe rivers and by improvement of the canal, at a cost estimated in 1886 at $92,000.

To June 30, 1894, $27,520.48 had been expended upon this work.

At that date an excellent channel 13,000 feet long, 30 feet wide, and 5 feet deep at low water had been dredged through the worst portions of Harlowe Creek, permitting through the natural channels a draft as great as can be carried through the canal, which is still owned and but poorly maintained by the Albemarle and Chesapeake Canal Company.

The money applied during the fiscal year ending June 30, 1895, was for the services of a traffic observer and for inspection.

July 1, 1894, balance unexpended	$7,512.12
June 30, 1895, amount expended during fiscal year	221.64
July 1, 1895, balance unexpended	7,290.48
July 1, 1895, outstanding liabilities	5.50
July 1, 1895, balance available	7,284.98
Amount (estimated) required for completion of existing project	57,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

(See Appendix K 7.)

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8. Harbor at Beaufort, N. C.—When its improvement by the United States (begun in 1836) was resumed in 1881, the erosion of Fort Macon and Shackleford points and widening of the entrance between them caused serious shoaling of the channel inside the bar, across which there was then a mid-channel depth of not less than 15.3 feet at low water. Within the harbor from the Bulkhead Channel a draft of only 2 feet at low water could be carried to the wharves at Beaufort.

The project of 1881 was to stop the erosion at Fort Macon and Shackleford points by jetties to prevent the widening and shoaling of the entrance; to dredge a channel 200 feet wide and 9 feet deep at low water from the Bulkhead Channel 1,950 feet to the wharves at Beaufort, and to dredge a channel 100 feet wide and 6 feet deep at mean low water from the 6-foot contour leading to North River, a distance of 12,670 feet.

In 1887 the project was modified by postponing for the present the dredging of the cut through the Old Town Channel to North River and by reducing to the width of 100 feet and depth of 5 feet the channel to be dredged from the Bulkhead Channel to Beaufort; and in 1890 the project was again modified by increasing the latter dredging to the depth of 7 feet. The cost of executing the project was estimated in 1887 at $163,000.

To June 30, 1895, $140,606.11 had been expended upon this work.

At that date the erosion of Fort Macon and Shackleford points had been arrested, and a cut 100 feet wide and 7 to 8 feet deep at low water had been dredged between the Bulkhead Channel, a distance of 1,895 feet, and the channel along the wharves at Beaufort; but at the entrance to the Bulkhead Channel from the main channel of the harbor a shoal had formed upon which the depth was 5.6 feet at low water, but which afterwards diminished to 4.1 feet.

With the amount applied during the fiscal year ending June 30, 1895, a cut 800 feet long, 100 feet wide, and 5 feet deep at low water has been dredged through the Bulkhead Channel Shoal, and the jetties, groins, and sand fences for the preservation of Fort Macon and Shackleford points have been kept in repair, and jetties at the latter extended where erosion was threatened.

July 1, 1894, balance unexpended	$9,759.54
June 30, 1895, amount expended during fiscal year	6,421.85
July 1, 1895, balance unexpended	3,337.69
July 1, 1895, outstanding liabilities	433.10
July 1, 1895, balance available	2,904.59
Amount (estimated) required for completion of existing project	13,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix K 8.)

9. Inland waterway between Beaufort Harbor and New River, North Carolina.—When the first appropriation was made in 1886, there were in the 28 miles in Bogue Sound from Beaufort to Swansboro six shoals aggregating about 4 miles in length, over which not more than 18 inches could be carried at low water. Elsewhere the channel was not less than 3 feet deep. From Swansboro 22 miles to New River, the route followed intricate tidal channels, varying from 1,000 to 12 feet in width and 10 feet to 6 inches in depth at ordinary low water.

The project adopted in 1885 embraced only that part of the route from Beaufort to Swansboro, and is to obtain a channel of the minimum

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depth of 3 feet and width of 100 feet by dredging through all the shoals, at an estimated cost of $50,000.

To June 30, 1894, $31,255.49 had been expended upon this work for this purpose.

At that date a channel of the variable widths of 40, 60, and 100 feet and not less than 3 feet deep at low water had been obtained by dredging through 6 shoals, aggregating 4.12 miles in length, but at two localities aggregating 1,927 feet between shoals which had been dredged, there was a depth of less than 3 feet, and at the shoalest point of only 2.5 feet at low water.

The amount expended during the fiscal year ending June 30, 1895, has been applied to surveys only and to entering into contract for dredging.

July 1, 1894, balance unexpended		$8,754.81
Amount appropriated by act of August 17, 1894		2,500.00
		11,254.81
June 30, 1895, amount expended during fiscal year		701.59
July 1, 1895, balance unexpended		10,553.22
July 1, 1895, outstanding liabilities	$21.99	
July 1, 1895, amount covered by uncompleted contracts	9,700.00	
		9,721.99
July 1, 1895, balance available		831.23
Amount (estimated) required for completion of existing project		7,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		1,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix K 9.)

10. Inland waterway between New River and Swansboro, N. C.—When the first appropriation was made, September 19, 1890, for its improvement the crooked and intricate tidal channel which this waterway follows 22 miles through the marshes between the mainland and outlying sand banks had at ordinary low water a minimum depth of about 6 inches upon the shoals or "divides," where the tides meet between the four inlets to it from the ocean, and varied from 12 to 1,000 feet in width.

The project of 1889 is to dredge a channel 40 feet wide and 4 feet deep at high water through the shoals, at a cost estimated at $43,000.

To June 30, 1894, $620 had been spent in surveying the shoals.

To this date, June 30, 1895, no work has been done, because the Wrightsville and Onslow Navigation Company claims to control the waterway under an act of the State of North Carolina of February 13, 1889. (See House Ex. Doc. No. 26, Fifty-second Congress, first session; also p. 1147 Annual Report Chief of Engineers, 1892.)

July 1, 1894, balance unexpended	$4,380.00
June 30, 1895, amount expended during fiscal year	2.19
July 1, 1895, balance unexpended	4,377.81
Amount (estimated) required for completion of existing project	38,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

(See Appendix K 10.)

11. New River, North Carolina.—In 1886, when the United States began the improvement, there was around Cedar Bush Marsh, 1½ miles above the mouth, a circuitous channel in which the depth was less

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than 4 feet on two shoals, and around Wrights Island, 700 yards above the bar, a circuitous channel but not less than 5 feet deep at mean low water. Except around Cedar Bush Marsh 4 feet could be carried from the ocean, 23 miles, to Jacksonville.

The project of 1882 was to straighten, widen to 150 feet, and deepen to 5 feet at mean low water, the channel around the marsh by dredging, at an estimated cost of $40,000.

The project of 1885 was to dredge a straight channel 4 feet deep at mean low water, 150 feet wide, and 5,710 feet long through Cedar Bush Marsh, instead of improving the channel around it; also to dredge a channel 4 feet deep, 150 feet wide, and 1,200 feet long through Wrights Island to replace the circuitous channel around it.

August 9, 1892, the project was modified to leave the cut through Wrights Island 100 feet wide, as then, instead of making it 150 feet wide, and June 18, 1894, the project was again modified to improve by a training wall and by dredging the channel around Cedar Bush Marsh in place of the cut made through the marsh, which had to be abandoned in consequence of shoaling at its upper extremity.

To June 30, 1894, $21,613.62 had been expended upon this improvement.

At that date there was a good channel 3.7 feet deep through Wrights Island, but a depth of only 3 feet at low water on the shoals in the channel around Cedar Bush Marsh.

With the amount applied during the fiscal year ending June 30, 1895, by building a training dike 1,495 feet long and by a little dredging, the depth of 4 feet has been obtained through the shoals in the channel around Cedar Bush Marsh, and there is now that depth from the mouth to Jacksonville as designed in the project, except for 400 feet at the upper end of Wrights Island, where the least depth in the channel is 3.4 feet.

July 1, 1894, balance unexpended	$11,473.68
June 30, 1895, amount expended during fiscal year	6,635.64
July 1, 1895, balance unexpended	4,838.04
July 1, 1895, outstanding liabilities	157.53
July 1, 1895, balance available	4,680.51
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	7,000.00

(See Appendix K 11.)

12. North East (Cape Fear) River, North Carolina.—When the United States began to improve it in 1890 a draft of at least 6 feet could be carried up 48 miles to Bannermans bridge at lowest stage. From Bannermans bridge 55 miles up to Kornegays bridge the river is so shallow its navigation even by flatboats is not usually practicable for any periods of considerable duration, but is dependent upon freshet stages, and therefore intermittent at all seasons of the year. Above Bannermans bridge it was badly obstructed by snags and overhanging trees.

The project of 1889 is to clear the channel to its natural depth and to a good width for small light-draft steamers up to Hallsville and for pole boats up to Kornegays bridge, at an estimated cost of $30,000.

To June 30, 1894, $8,272.28 had been expended upon this improvement.

At that date the channel had been cleared of snags and overhanging trees up to within 3 miles of Kornegays bridge.

No work has been done during the fiscal year ending June 30, 1895. The amount expended has been applied to the plant.

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July 1, 1894, balance unexpended	$1,999.94
Amount appropriated by act of August 17, 1894	5,000.00
	6,999.94
June 30, 1895, amount expended during fiscal year	1,289.45
July 1, 1895, balance unexpended	5,710.49
July 1, 1895, outstanding liabilities	12.29
July 1, 1895, balance available	5,698.20
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	15,000.00

(See Appendix K 12.)

13. Black River, North Carolina.—When the United States began to improve this river in 1887 the channel from the mouth 24 miles to Point Caswell was fairly cleared to a depth not less than 4 feet at low summer stages, and was roughly cleared 62 miles farther to Lisbon, with a least channel depth of 2½ feet at low stage in the 10 miles from Point Caswell to Haws Narrows; thence 52 miles to Lisbon the depth at low summer stage was 18 inches to 3 feet on the shoals and 10 to 12 feet in the pools.

The project of 1885 was to apply at least $10,000 to removing logs, snags, and overhanging trees from the bed and banks and rounding off a few of the sharpest bends in the river from its confluence with the Cape Fear up 74 miles to Lisbon. In 1893 it was modified to confine the improvement to the 64 miles up to Clear Run.

To June 30, 1894, $10,678.67 had been expended upon this work.

At that date the channel had been cleared of snags and overhanging trees up to Clear Run bridge in accordance with the project.

With the amount applied during the fiscal year ending June 30, 1895, the channel was cleared of the snags and overhanging trees carried into the river by the gales of September and October, 1894.

July 1, 1894, balance unexpended	$2,326.18
Amount appropriated by act of August 17, 1894	2,000.00
	4,326.18
June 30, 1895, amount expended during fiscal year	1,684.58
July 1, 1895, balance unexpended	2,641.60
July 1, 1895, outstanding liabilities	21.12
July 1, 1895, balance available	2,620.48
Amount that can be profitably expended for maintenance in fiscal year ending June 30, 1897. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	1,000.00

(See Appendix K 13.)

14. Cape Fear River above Wilmington, N. C.—When the United States began to improve it in 1882 a draft of 4 feet could be carried at lowest stages 47 miles above Wilmington to Kellys Cove; thence 68 miles to Fayetteville there were many shoals, on some of which the depth was not more than 12 to 14 inches during the low stage; from Indian Wells Landing, 37 miles above Wilmington, 78 miles to Fayetteville, the river was badly obstructed by snags, logs, and overhanging trees.

The project of 1881, as matured in 1885 and 1886, is to obtain at all times of the year a depth of 4 feet from Wilmington 73 miles to Elizabethtown, and of 3 feet thence 42 miles to Fayetteville, by removing snags and rock from the bed and overhanging trees from the banks,

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by contracting the channel by jetties on the shoals, and by a little dredging at a bar of clay, at a total cost estimated in 1886 at $472,000.

To June 30, 1895, $116,189.01 had been expended upon this work.

At that date between Kellys Cove and Elizabethtown there were 16 shoals, having a total length of 6½ miles, on which the depth was less than 4 feet and over the worst of which not more than 2½ feet could be carried at low water, and between Elizabethtown and Fayetteville there were 28 shoals, having a total length of 17 miles, on which the depth was less than 3 feet at low water and over the worst of which not more than 1 foot could be carried at that stage.

With the amount applied during the fiscal year ending June 30, 1895, 570 linear feet of longitudinal jetties of sheet piles has been built on the worst shoals between Fayetteville and Elizabethtown and the main piles driven for 1,600 linear feet of longitudinal jetties on the worst shoals below Fayetteville, and 41 miles of channel has been cleared of snags.

The prevalence of unusually high water since January 8, 1895, has prevented the completion of the latter jetties and also prevented ascertaining the effect of the former upon the channel.

July 1, 1894, balance unexpended	$2,388.66
Amount appropriated by act of August 17, 1894	14,000.00
	16,388.66
June 30, 1895, amount expended during fiscal year	6,672.12
July 1, 1895, balance unexpended	9,716.54
July 1, 1895, outstanding liabilities	38.28
July 1, 1895, balance available	9,678.26
Amount (estimated) required for completion of existing project	142,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	5,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix K 14.)

15. Cape Fear River at and below Wilmington, N. C.—The United States began to improve the river between the bar and Wilmington in 1829 and the channel on the bar in 1853. In 1829 the river was so obstructed that vessels drawing more than 10 feet were obliged to anchor 14 miles below Wilmington and discharge a part of their cargoes into lighters. In 1853 at low water on the bar the least mid-channel depth was 7 feet in the western channel, 7½ feet in the eastern channel, and 8 feet at New Inlet, 7 miles above the mouth.

The original project of 1827 was to deepen the channel through the shoals in the 8 miles next below Wilmington by contracting it by jetties and by diverting into it water from Brunswick River and from Fishing and Rodmans creeks.

The project of 1853 was to straighten and deepen the channel on the bar by building jetties and a wing dam, by dredging, by diverting water through it from New Inlet, by building a jetty at Federal Point, and by closing two small breaches in Zekes Island.

The project of 1870 was to deepen the bar channel by closing the breaches between Smiths and Zekes islands, with the ultimate closure of New Inlet in view.

The project of 1873 was to deepen the channel through the bar, added to that of 1870, to dredge in the Baldhead (eastern) Channel, to extend across Zekes Island and beyond it into the river the dam then being built to close the breaches between Smiths and Zekes islands, and to close New Inlet, commencing with the building of a jetty from Federal Point.

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The project of 1874 was "to get 12 feet at low water as high as the city of Wilmington" by dredging a channel 100 feet wide through Horseshoe Shoal below New Inlet and through three other shoals near Wilmington.

The project of 1881 was to dredge a channel 2¾ miles in length through Horseshoe Shoal and through eight other shoals above it 270 feet wide and 16 feet deep at mean low water from deep water at Smithville (Southport) to Wilmington.

February 28, 1889, pursuant to a requirement of the river and harbor act of August 11, 1888, the cost of obtaining a channel 20 feet deep at mean low water from Wilmington to the ocean was reported to be $1,800,000. In the Annual Report for 1889 it was reported that an additional appropriation of $25,000 would be required to complete the project of 1881 and obtain a channel 16 feet deep from Wilmington to the ocean. By the river and harbor act of September 19, 1890, Congress appropriated $170,000 for improving the Cape Fear River at and below Wilmington, and dredging to the depth of 20 feet commenced at Wilmington January 19, 1891, and ceased at Brunswick River Shoal, 4½ miles below Wilmington, September 7, 1892.

Since September 7, 1892, work has been in progress to obtain a channel through the shoals between Wilmington and the bar, and on the latter 18 feet deep at mean low water.

To June 30, 1894, $2,427,584.46 (including outstanding liabilities) had been expended upon this improvement.

At that date the depth of the channel at mean low water was as follows: From Wilmington, 20 miles, to Snows Marsh Shoal, 18 feet, except where shoaling had occurred at the lower extremity of Lilliput Shoal, where the depth was 16½ feet and the bottom of very soft sludge; at Snows Marsh Shoal 14 feet; on the inner shoals at the bar 16 feet by a crooked channel and 14.3 feet by a straight course, and on the outer bar 16.6 feet.

With the amount applied during the fiscal year ending June 30, 1895, a channel has been obtained 18 feet deep at mean low water, of variable widths but nowhere less than 148 feet, through all the shoals except that at Snows Marsh, where the depth is 16.7 feet; a training dike 5,692 feet in length has been built at the latter locality; a suction dredging steamer has been built under contract and placed in operation on the bar and at Snows Marsh Shoal, and a breach made by the sea in the east bank of the river around the end of New Inlet Dam was closed by the deposit of 1,353 tons of granite. Twenty-four square miles of hydrography and 27 miles of shore line have been surveyed.

July 1, 1894, balance unexpended		$101,538.34
Amount appropriated by act of August 17, 1894		200,000.00
		301,538.34
June 30, 1895, amount expended during fiscal year		176,262.63
July 1, 1895, balance unexpended		125,275.71
July 1, 1895, outstanding liabilities	$4,849.14	
July 1, 1895, amount covered by uncompleted contracts	2,860.00	
		7,709.14
July 1, 1895, balance available		117,566.57
Amount (estimated) required for completion of existing project, If to 18 feet		200,000.00
Amount (estimated) required for completion of existing project, If to 20 feet		1,230,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		195,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix K 15.)

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16. Lockwoods Folly River, North Carolina.—When the United States began this improvement in 1892 the depth on the changeable ocean bar was usually 4 feet at low and 8 feet at high water. These depths could be carried at low stages 1½ miles up the channel to a mud flat over which for 1½ miles the channel depth averaged less than 1 foot at low water. A little above these flats there was a shoal 300 feet long upon which the depth at low water was about 2½ feet, thence about 22 miles by river to Lockwoods Folly Bridge the depth was nowhere less than 5 feet.

The project was adopted in 1887 to dredge a channel through the flats 100 feet wide and 7 feet deep at low water.

To June 30, 1894, $5,000 had been expended upon this improvement.

At that date one cut 40 feet wide and 5 feet deep at low water had been dredged the length of 2,530 feet, about one-third of the distance, through the shoal.

With the amount applied during the fiscal year ending June 30, 1895, the cut 40 feet wide and 5 feet deep had been extended 1,150 feet into the mud flats by the removal of 9,478 cubic yards of material.

July 1, 1894, balance unexpended		$3,000.00
Amount appropriated by act of August 17, 1894		10,000.00
		13,000.00
June 30, 1895, amount expended during fiscal year		305.50
July 1, 1895, balance unexpended		12,694.50
July 1, 1895, outstanding liabilities	$1,939.75	
July 1, 1895, amount covered by uncompleted contracts	10,199.18	
		12,138.93
July 1, 1895, balance available		555.57
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.		22,000.00

(See Appendix K 16.)

17. Georgetown Harbor, South Carolina.—This harbor is that part of the Sampit River immediately within the bar at its mouth, near the head of Winyaw Bay.

When the United States began to improve it in 1884 there was in the channel on the ocean bar at the mouth of the bay at low water about 8¾ feet and about 12 feet at high water; thence up the bay there was a depth of 13 feet to the bar at the mouth of the Sampit, upon which there was only 9 feet at ordinary low water.

The project of 1881 was to dredge a channel 200 feet wide to the depth of 12 feet at ordinary low water through this shoal or bar to permit vessels to reach the wharves at Georgetown.

To June 30, 1894, $42,875.02 had been expended upon this work.

At that date a channel 12 feet deep had been dredged entirely through the shoal to the prescribed width of 200 feet, and a few logs which afterwards accumulated in it had been removed.

The small amount applied during the fiscal year ending June 30, 1895, has been for office expenses.

July 1, 1894, balance unexpended	$1,627.58
June 30, 1895, amount expended during fiscal year	17.75
July 1, 1895, balance unexpended	1,609.83
July 1, 1895, outstanding liabilities	89.00
July 1, 1895, balance available	1,520.83

(See Appendix K 17.)

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18. Winyaw Bay, South Carolina.—When the United States began to improve it in 1890, there was at mean low water in the main (southerly) channel on its ocean bar 7 to 9 feet, and in the Bottle (easterly) Channel 6 to 8 feet of water, both channels being changeable; thence 12 miles to the head of the bay vessels could draw 12 feet at lowest tides.

The project of 1885, as approved by the Board of Engineer Officers in 1888 and by the Chief of Engineers in 1889, is to increase the depth of water in Bottle Channel to about 15 feet at mean low water by building to the height of 6 feet above that plane a jetty from North Island 10,700 feet long and a jetty from South Island 17,500 feet long across the main channel to the 18-foot curve, at a total estimated cost of $2,500,000.

To prevent injury to the entrance to the bay by the flow of the tide over the marsh extending on South Island from the ocean to the bay just above its entrance, the building of an earth dike 12,260 feet long was authorized by the Chief of Engineers in May, 1892.

To June 30, 1894, $316,031.99 (including outstanding liabilities) had been expended upon this work.

At that date the north jetty had been built to a distance of 2,220 feet from the shore and height of 18 inches above mean low water, and the earth dike on South Island had been built to full dimensions for a length of 1,800 feet and to about two-thirds cross section for a farther length of 1,150 feet.

With the amount applied during the fiscal year ending June 30, 1895, the north jetty has been extended a distance of 1,950 feet at the height of 18 inches above mean low water and 1,955 feet farther to a height gradually diminishing to the thickness of the ballast on the mattresses; the earth dike on South Island has been extended with full dimensions a distance of 8,100 feet and with about two-thirds cross section a farther distance of 1,210 feet, stopping the flow of the tide across the marsh, and 18 spur jetties or groins of brush mattresses ballasted with stone, aggregating 1,386 linear feet, and 1,225 linear feet of connecting post and brush sand-catcher have been built to stop erosion of the shore of South Island at the entrance to the passage from the ocean to the bay. The 12-foot and 15-foot contours have advanced 800 and 700 feet respectively into Bottle Channel, but the depth on its bar has not increased.

July 1, 1894, balance unexpended		$32,881.70
Amount appropriated by act of August 17, 1894		110,000.00
		142,881.70
June 30, 1895, amount expended during fiscal year		76,520.19
July 1, 1895, balance unexpended		66,361.51
July 1, 1895, outstanding liabilities	$23,029.14	
July 1, 1895, amount covered by uncompleted contracts	27,131.99	
	*9,255.26	
		59,416.39
July 1, 1895, balance available		6,945.12

Amount (estimated) required for completion of existing project..... 2,071,250.00

Amount that can be profitably expended in fiscal year ending June 30, 1897..... 200,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix K 18.)

*Includes 7,120.35 cubic yards material ($1,922.49) placed in dike by contractor but not yet accepted.

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EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations and surveys of the following localities, required by the act of August 17, 1894, were made by the local engineer, Maj. W. S. Stanton, Corps of Engineers, and reports submitted through the division engineer, Col. William P. Craighill, Corps of Engineers:

1. Preliminary examination of Turners Cut, North Carolina.—Major Stanton submitted report of examination January 9, 1895. He reports that, apart from its being the property of a corporation, in his opinion the locality is not worthy of improvement by the General Government. The division engineer is of opinion that the cut is not worthy of improvement at this time. The views of these officers are concurred in by this office. The report was transmitted to Congress and printed in House Ex. Doc. No. 213, Fifty-third Congress, third session. (See also Appendix K 20.)

2. Preliminary examination of Scuppernong River, North Carolina.—Major Stanton submitted report of examination January 11, 1895. He is of opinion that the locality is at present not worthy of improvement by the General Government, and his views are concurred in by the division engineer and by this office. The report was transmitted to Congress and printed in House Ex. Doc. No. 217, Fifty-third Congress, third session. (See also Appendix K 21.)

3. Preliminary examination of Tar River, North Carolina, from Washington to Greenville, with a view to obtaining a depth of 3 feet.—Major Stanton submitted report of examination August 23, 1894. He states that the channel of Tar River is nowhere less than 3 feet at low water between Washington and Greenville. The report was transmitted to Congress and printed in House Ex. Doc. No. 62, Fifty-third Congress, third session. (See also Appendix K 22.)

4. Preliminary examination of South Creek, North Carolina, mouth to head of navigation.—Major Stanton submitted report of examination January 10, 1895. It is his opinion and that of the division engineer, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 221, Fifty-third Congress, third session. (See also Appendix K 23.)

5. Preliminary examination of Drum Inlet, North Carolina, between Portsmouth and Cape Lookout.—Major Stanton submitted report of examination January 28, 1895. In his opinion, concurred in by the division engineer and by this office, the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 296, Fifty-third Congress, third session. (See also Appendix K 24.)

6. Preliminary examination of Core Sound, North Carolina.—Major Stanton submitted report of examination February 14, 1895. In his opinion, concurred in by the division engineer and by this office, the locality is not at this time worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 333, Fifty-third Congress, third session. (See also Appendix K 25.)

7. Preliminary examination of Cape Lookout Harbor of Refuge, North Carolina.—Major Stanton submitted report of examination February 12, 1895. It is his opinion and that of the division engineer, concurred in by this office, that this harbor is worthy of improvement by the

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General Government to the extent of taking suitable means by sand-catching and beach-building devices to prevent the movement of sand into it from the adjacent beaches and sand dunes by the wind and sea. No survey is necessary for the preparation of project and estimate of cost of the improvement. The report was transmitted to Congress and printed in House Ex. Doc. No. 319, Fifty-third Congress, third session. (See also Appendix K 26.)

8. Preliminary examination of water route from mouth of North River to Beaufort Harbor, North Carolina.—Major Stanton submitted report of examination January 26, 1895. In his opinion, concurred in by the division engineer and by this office, this water route is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 302, Fifty-third Congress, third session. (See also Appendix K 27.)

9. Survey of Alligator River, North Carolina.—Major Stanton submitted report of survey January 26, 1895. The river has heretofore twice been examined and two adverse reports submitted—one by Captain Mercur in 1883, and the other by Captain Hinman in 1886. Major Stanton now presents a project for improvement by straightening the 4 miles of the river next below the Fairfield Canal by making 13 cut-offs 30 feet wide and 7½ feet deep below the water surface. The estimated cost of the improvement proposed is $6,000. The report was transmitted to Congress and printed in House Ex. Doc. No. 297, Fifty-third Congress, third session. (See also Appendix K 28.)

10. Survey of North East (Cape Fear) River, North Carolina, from the old county ferry to Juniper Swamp or Creek, a point about 1 mile north of Hilton Railroad bridge, with a view to obtaining an increased depth of channel.—Major Stanton submitted report of survey February 7, 1895. He states that the proprietors of the fertilizer factory and of the sawmill on the west bank, about 4,200 feet and 5,400 feet, respectively, above the railroad bridge, desire the channel for a width of 100 feet dredged so that at mean low water vessels can draw 17 feet up to the factory wharf and 16 feet thence to the sawmill wharf; and he estimates that to dredge a channel to permit such drafts will require the excavation of 50,000 cubic yards of mud and sand, at an estimated cost of $10,000. The report was transmitted to Congress and printed in House Ex. Doc. No. 322, Fifty-third Congress, third session. (See also Appendix K 29.)

Major Stanton was also charged with the duty of making survey of *Cape Fear River above Fayetteville, N. C.*, and report of results will be duly submitted when received.

IMPROVEMENT OF WACCAMAW AND LUMBER RIVERS, NORTH CAROLINA AND SOUTH CAROLINA, AND OF CERTAIN RIVERS AND HARBORS IN SOUTH CAROLINA.

This district was in the charge of Capt. Frederic V. Abbot, Corps of Engineers; Division Engineers, Col. William P. Craighill, Corps of Engineers, to May 18, 1895, and Lieut. Col. Peter C. Hains, Corps of Engineers, since that date.

1. Waccamaw River, North Carolina and South Carolina.—In 1880 this river was navigable for boats of 12 feet draft at all stages of water from Georgetown 23 miles to Bull Creek, and at high water 4 miles farther to Buck's lower mills; thence for boats of 7 feet draft at high water 22 miles farther to Conway; thence it possessed an obstructed channel for boats of 3 feet draft at ordinary winter water 68 miles to Reeves Ferry; thence an obstructed channel with 3 feet depth at high water 30 miles to Lake Waccamaw.

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The project provides for a channel 12 feet deep at all stages of water and 80 feet bottom width from the mouth of the river to Conway; thence a cleared channel to Lake Waccamaw. The estimated cost is $138,400.

The work of the year has been snagging. Up to June 30, 1895, $89,664.40 has been spent, giving a thoroughly cleared channel with 100 feet least width 7 feet deep at low water as far as Conway, and 40 feet width and 3 feet deep 72 miles above Conway.

The commerce of the year amounts to 128,466 tons.

July 1, 1894, balance unexpended	$1,046.90
Amount appropriated by act of August 17, 1894	6,000.00
	7,046.90
June 30, 1895, amount expended during fiscal year	2,811.30
July 1, 1895, balance unexpended	4,235.60
July 1, 1895, outstanding liabilities	330.00
July 1, 1895, balance available	3,905.60
Amount (estimated) required for completion of existing project	44,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	6,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix L 1.)

2. Lumber River, North Carolina and South Carolina.—The river was obstructed by logs, snags, and overhanging trees and in places by sandbars. It was crossed by a number of bridges without draws. The project contemplates the removal of snags, logs, overhanging trees, etc., for 70 miles below Lumberton, at an estimated cost of $35,000. The work of the year has been snagging. The railroad bridge in South Carolina has been supplied with a steel draw. The North Carolina bridges have been provided with drawspans or discontinued. The commerce of the year amounts to 19,131 tons. Total expenditures to June 30, 1895, $15,476.48.

July 1, 1894, balance unexpended	$87.93
Amount appropriated by act of August 17, 1894	4,000.00
	4,087.93
June 30, 1895, amount expended during fiscal year	564.41
July 1, 1895, balance unexpended	3,523.52
July 1, 1895, outstanding liabilities	225.00
July 1, 1895, balance available	3,298.52
Amount (estimated) required for completion of existing project	16,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

(See Appendix L 2.)

3. Little Pedee River, South Carolina.—This river was much obstructed by snags and overhanging trees, and in places was subdivided into several branches. The project contemplates providing for steamboat navigation to Lumber River and pole-boat navigation to Little Rock. The estimated cost is $50,000. All bridges on that part of river improved for steamers have been supplied with draws. The work of the year has been snagging. This year's commerce amounts to 12,438 tons. Total expenditures to June 30, 1895, $15,395.13.

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July 1, 1894, balance unexpended	$781.82
Amount appropriated by act of August 17, 1894	4,000.00
	4,781.82
June 30, 1895, amount expended during fiscal year	1,176.95
July 1, 1895, balance unexpended	3,604.87
July 1, 1895, outstanding liabilities	300.00
July 1, 1895, balance available	3,304.87

Amount (estimated) required for completion of existing project	31,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	4,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix L 3.)

4. Great Pedee River, South Carolina.—The river was dangerously obstructed by snags and logs. The project provides for thoroughly cleared 9-foot navigation 52 miles to Smith Mills, and 3½-foot navigation to Cheraw, 172 miles above the mouth, at all stages of water, at an estimated cost of $117,000. The work of the year has been snagging. This year's commerce amounts to 106,115 tons. Total expenditures to June 30, 1895, $90,672.65.

July 1, 1894, balance unexpended	$2,147.63
Amount appropriated by act of August 17, 1894	6,000.00
	8,147.63
June 30, 1895, amount expended during fiscal year	3,320.28
July 1, 1895, balance unexpended	4,827.35
July 1, 1895, outstanding liabilities	219.92
July 1, 1895, balance available	4,607.43

Amount (estimated) required for completion of existing project	21,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	15,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix L 4.)

5. Clark River, South Carolina.—This river forms the southern mouth of Lynch River. Its upper end was entirely choked by driftwood and fallen trees. The project provides for closing the northern mouth of Lynch River and snagging Clark River. The estimated cost is $7,500. No work was done on account of the lack of funds. All that is needed before Lynch River is opened for steamers has been done. This year's commerce amounts to about 7,000 tons. Total expenditures to June 30, 1895, $7,500.

July 1, 1894, balance unexpended	$35.42
June 30, 1895, amount expended during fiscal year	35.42

(See Appendix L 5.)

6. Mingo Creek, South Carolina.—This stream was much obstructed by snags and overhanging trees. The project provides for removing obstructions from the mouth to Williams Landing for steamboat navigation and above for pole-boat navigation. The estimated cost is $17,000. The work of the year has been snagging. This year's commerce amounts to 136,957 tons. Total expenditures to June 30, 1895, $14,116.39.

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July 1, 1894, balance unexpended	$31.06
Amount appropriated by act of August 17, 1894	4,000.00
	4,031.06
June 30, 1895, amount expended during fiscal year	1,147.45
July 1, 1895, balance unexpended	2,883.61
July 1, 1895, outstanding liabilities	200.00
July 1, 1895, balance available	2,683.61

(See Appendix L 6.)

7. Santee River, South Carolina.—This river was obstructed by sunken logs and snags. The bar was narrow, crooked, and shifting, with only about 4 feet depth at low tide. The project provides for leaving the Mosquito Creek Canal, which has been completed for about $100,000, as a lumber route, and for a new cut between Estherville and Minim Creek at an estimated cost of $250,000, and for completely snagging the Santee River itself at a cost of $100,000. During the year dredging on the new canal continued with the dredge owned and operated by the United States, at a cost of between 4 and 5 cents a cubic yard. The lowest price here by contract was over 35 cents, about eight times greater than this year's cost by hired labor.

Up to June 30, 1895, $170,861.40 had been spent in giving a passage 30 feet wide and 3 feet deep at high water from Santee River to Winyaw Bay, in building a drawbridge over Mosquito Creek, in replacing damaged rice-land drainage, and dredging on the Estherville-Minim Creek Canal. This year's commerce amounted to 117,690 tons.

July 1, 1894, balance unexpended	$1,734.38
Amount appropriated by act of August 17, 1894	40,000.00
	41,734.38
June 30, 1895, amount expended during fiscal year	12,845.78
July 1, 1895, balance unexpended	28,888.60
July 1, 1895, outstanding liabilities	2,700.00
July 1, 1895, balance available	26,188.60
Amount (estimated) required for completion of existing project	250,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	60,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix L 7.)

8. Wateree River, South Carolina.—This river had a low-water depth of from 3 to 4 feet from its mouth, 67 miles, to Camden. It was much obstructed by snags, and by two railroad bridges without draws. The project provides for 4-foot steamboat navigation to Camden. Total expenditures to June 30, 1895, $63,562.50.

The appropriation of September 19, 1890, completes the original estimated cost and for this sum the river has been put into a satisfactory condition. The engineer officer in charge reports that an annual appropriation of $6,500 is needed for maintenance. This year's commerce amounts to 21,697 tons.

July 1, 1894, balance unexpended	$570.26
Amount appropriated by act of August 17, 1894	2,500.00
	3,070.26
June 30, 1895, amount expended during fiscal year	1,632.76
July 1, 1895, balance unexpended	1,437.50
July 1, 1895, outstanding liabilities	100.00
July 1, 1895, balance available	1,337.50
Amount (estimated) required for annual maintenance	6,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

(See Appendix L 8.)

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9. Congaree River, South Carolina.—This river had a low-water depth of from 3 to 4 feet from its mouth, 48 miles, to the railroad bridge at Columbia, thence 1-foot low-water depth 2 miles farther. The lower 47 miles, from Granby to the mouth, was blocked by snags and a railroad bridge without a draw. The 3 miles above Granby was impassable, being rapids. The original project provides for 4-foot navigation below Granby and a cleared channel through the rapids above. Total expenditures to June 30, 1895, $25,514.79. This year's commerce amounts to 8,993 tons.

July 1, 1894, balance unexpended	$498.25
Amount appropriated by act of August 17, 1894	4,000.00
	4,498.25
June 30, 1895, amount expended during fiscal year	1,013.04
July 1, 1895, balance unexpended	3,485.21
July 1, 1895, outstanding liabilities	210.00
July 1, 1895, balance available	3,275.21

Amount (estimated) required for completion of existing project	25,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	2,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix L 9.)

10. Charleston Harbor, including Sullivan Island and Mount Pleasant shore, South Carolina.—The work in progress since 1878 comprises two jetties of riprap with mattress foundation and in some places of mattress hearting. The jetties spring from Morris and Sullivan islands and converge on curves so as to cross the bar on parallel lines about 2,900 feet apart. They are to establish and maintain a channel across the bar not less than 21 feet deep at low water where heretofore the low-water depth has not exceeded 12 feet. The action of the jetties is to be assisted by dredging. Estimated cost of the jetties up to low water, $4,380,500; up to 3 feet above mean low water, $5,334,500.

Dredging continued throughout the year under contract with Messrs. Egan & Friday, using the Government dredge and a dredge they rented from Morris & Cummings. Stone work continued under the contract with the same firm. During the year 146,324 tons of stone was deposited on the jetties, and 592,562 cubic yards of material was dredged. No settlement of the jetties has occurred during the year, but some of the very high portions had the top knocked off down to high-water mark by the waves. No practical injury has thus resulted. About 2¼ miles of the South Jetty and 1¾ miles of the North Jetty have been raised to high-water since work began.

The annual survey shows a marked improvement in the jetty channel, which is generally deeper and wider than last year. There is now 17 feet of water sufficiently wide for navigation all the way through at low tide. This corresponds with 22 feet at high water of ordinary tides. Total expenditures to June 30, 1895, $3,707,932.77.

July 1, 1894, balance unexpended		$237,265.36
Amount appropriated by sundry civil act approved August 18, 1894		450,000.00
Amount appropriated by sundry civil act approved March 2, 1895		500,000.00
		1,187,265.36
June 30, 1895, amount expended during fiscal year		767,698.13
July 1, 1895, balance unexpended		419,567.23
July 1, 1895, outstanding liabilities	$100,800.00	
July 1, 1895, amount covered by uncompleted contracts	20,000.00	
		120,800.00
July 1, 1895, balance available		298,767.23

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Amount (estimated) required for completion of existing project	$253,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix L 10.)

11. Ashley River, South Carolina.—The plan of improvement comprises the removal of a shoal about 8 miles above the city of Charleston, S. C., where there was only 9 feet of water at low tide, and another just below the old Wando Phosphate works, was only 6 feet. Low-water depths of from 10 to 11 feet with widths of from 100 to 200 feet have been obtained. The year's commerce amounts to about 460,000 tons. Total expenditures to June 30, 1895, $5,500.

July 1, 1894, balance unexpended	$1.77
June 30, 1895, amount expended during fiscal year	1.77

(See Appendix L 11.)

12. Wappoo Cut, South Carolina.—The project provides for a channel 60 feet wide and 6 feet deep at low water between Ashley and Stono rivers. There is now a narrow 5½-foot channel all the way through. This year's commerce amounts to 238,350 tons. Total expenditures to June 30, 1895, $58,479.71.

July 1, 1894, balance unexpended	$2,715.72
Amount appropriated by act of August 17, 1894	7,000.00
	9,715.72
June 30, 1895, amount expended during fiscal year	8,195.43
July 1, 1895, balance unexpended	1,520.29
July 1, 1895, outstanding liabilities	6.00
July 1, 1895, balance available	1,514.29

Amount (estimated) required for completion of existing project	28,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	2,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix L 12.)

13. Edisto River, South Carolina.—The river was much obstructed by snags and shoals. The project provides for a channel for rafts and flatboats from the sea, 260 miles, to Guignard Landing, on the South Fork, at an estimated cost of $33,385. No work has been done during the year. The project has been satisfactorily completed for less than the estimated cost.

This year's commerce amounts to 177,000 tons. Total expenditures to June 30, 1895, $33,043.33.

July 1, 1894, balance unexpended	$374.70
June 30, 1895, amount expended during fiscal year	33.03
July 1, 1895, balance unexpended	341.67
July 1, 1895, outstanding liabilities	15.00
July 1, 1895, balance available	326.67

Amount (estimated) required for completion of existing project	2,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	1,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix L 13.)

14. Salkahatchie River, South Carolina.—The river was very much obstructed by snags. The project provides for a continuous flatboat

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channel from 5 miles above Toby Bluff to Hickory Hill, at an estimated cost of $18,000. This year's commerce has amounted to 30,000 tons. The last appropriation completes the estimated cost, and no further funds will be required, the improvement being completed and a sufficient balance being left for maintenance. Total expenditures to June 30, 1895, $15,793.07.

July 1, 1894, balance unexpended	$2,621.15
June 30, 1895, amount expended during fiscal year	414.22
July 1, 1895, balance unexpended	2,206.93
July 1, 1895, outstanding liabilities	2.00
July 1, 1895, balance available	2,204.93

(See Appendix L 14.)

15. Beaufort River, South Carolina.—The portion to be improved is near Coosaw River, where there was only about 4 feet depth at low water for a short distance. A through channel 7 feet deep has been provided by dredging, as projected. The estimated cost is $40,000. Total expenditures to June 30, 1895, have been $25,221.90. This year's commerce amounts to 193,985 tons.

July 1, 1894, balance unexpended	$29.07
Amount appropriated by act of August 17, 1894	5,000.00
	5,029.07
June 30, 1895, amount expended during fiscal year	250.97
July 1, 1895, balance unexpended	4,778.10
Amount (estimated) required for completion of existing project	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	1,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix L 15.)

16. Removing sunken vessels or craft obstructing or endangering navigation.—Wreck of schooner Kate V. Aitken in Swash Channel, Charleston Harbor, South Carolina.—The contractors did not resume work and their contract was annulled.

Wreck of sloop in draw span in the Ashley River bridge.—The mast and part of the sloop were removed by the Charleston contractors at a cost of only $5.

Wrecks in Ashley River, South Carolina.—Five wrecks were inspected; four were found to be of no danger to navigation, or were within dock lines. One was buoyed by the light-house inspector, as it is dangerous, but it was not removed, as it was well outside the channel line and was merely a light flat that will go to pieces in a short time.

The sum of $37.37 was expended during the year upon work of removing wrecks.

(See Appendix L 16.)

IMPROVEMENT OF RIVERS AND HARBORS IN EASTERN GEORGIA.

This district was in the charge of Capt. O. M. Carter, Corps of Engineers; Division Engineers, Col. William P. Craighill, Corps of Engineers, to May 18, 1895, and Lieut. Col. Peter C. Hains, Corps of Engineers, since that date.

1. Savannah Harbor, Georgia.—The plan of improvement under which operations have been carried on in Savannah Harbor during the last fiscal year was approved by the Secretary of War on July 22, 1890. The project contemplates the establishment of a navigable channel

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26 feet deep at mean high water between the city of Savannah and Tybee Roads. The mean rise and fall of tide varies from about 7 feet at Fort Pulaski to about 6 feet in front of the city wharves.

The estimated cost of the improvement is $3,500,000.

In 1873, prior to improvement, the channel was in places not more than 9 feet deep at mean low water, and the usual high-water draft of vessels was not more than 14.5 feet.

Prior to July 1, 1894, there had been placed in the work under the present project 1,012,424.44 square yards of log and brush mattresses, 217,776.06 cubic yards of brush fascines, 95,271.77 cubic yards of riprap stone, 12,596 piles, and aside from these, 709 groups of tie piles and 74 clusters of fender piles; also 627,326.6 feet, B. M., of 6 by 10 inch timber, and 66,552.38 pounds of iron bolts. There had been removed from the channel by dredging 1,898,930.64 cubic yards of material.

The removal of a number of old crib obstructions and wing dams projecting too far into the channel had been commenced by the snag boats *Toccoa* and *Satilla*, the work being done by hired labor and the purchase of material in open market. The material removed at various places consisted of 2,400 feet, B. M., of sawed timber, 216¾ cubic yards of riprap stone, 2,759 logs, and 35 piles.

A steam hoister for use upon the rivers and in Savannah Harbor had been constructed by hired labor and purchase of material in open market.

The total expenditure under the present project to June 30, 1894, including all outstanding liabilities, amounted to $2,076,649.63.

The river and harbor act approved July 13, 1892, contained an appropriation of $318,750 for continuing this improvement, with the following provision:

Provided, That contracts may be entered into by the Secretary of War for such materials and work as may be necessary to complete the present project of improvement, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate two million eight hundred and thirty-one thousand two hundred and fifty dollars, exclusive of the amount herein and heretofore appropriated.

A contract was entered into with P. Sanford Ross, of Jersey City, N. J., for all of the dredging, and with The Atlantic Contracting Company, of New York, for all of the other work required for the improvement.

During the fiscal year just closed there were used in the Marsh Island training wall, the Garden Bank training wall, the Mackay Point training wall, the South Channel training wall and spurs, the Barnwell Island closing dams, the Barnwell Island training wall, the Barnwell Island spur dams, the North Elba Island training wall, the South Elba Island training wall, the Elba and Jones Island spur dams, Wing Dam No. 14, the Venus Point training wall, the Long Island training wall, the Oyster Bed training wall, and the Cockspur Island training wall, 413,350.43 square yards of brush mattresses, 40,289.20 cubic yards of brush fascines, 48,950.51 cubic yards of riprap stone, 74,356 feet, B. M., of 6 by 10 inch timber, and 9,621.01 pounds of iron bolts. There were driven 552 piles, making an aggregate advance of pile work of 2,296 linear feet. There were also driven 18½ groups of tie piles and 18⅓ clusters of fender piles, making a total of 644 piles driven during the fiscal year.

Between the old waterworks and the sea 1,866,723.5 cubic yards of material was removed by dredging during the fiscal year.

The removal of old crib obstructions and wing dams projecting too far into the channel was continued. There were removed at various places 1,030 logs, piles, and stumps.

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There were put up by special authority 31 day marks, marking the dredged channel from Marsh Island to Tybee Knoll. This work was done by day labor and purchase of material in open market.

Besides the usual examinations and surveys a detailed survey has been made of the city front and the opposite shore in order to establish the harbor line of the port.

The total expenditures during the year ending June 30, 1895, including all outstanding liabilities, amounted to $1,600,510.76.

There is now a navigable channel from the city to the sea with a minimum low-water depth of 19 feet, a gain of about 10 feet since the work began and of 3 feet during the fiscal year just closed.

The river and harbor act of August 17, 1894, provided as follows:

Harbor of Savannah, Georgia: The Secretary of War is hereby directed to report whether the works projected for the improvement of the harbor will, when completed, afford safe anchorage for vessels lying in Tybee Roads; if not, whether there is any necessity for so constructing them, giving, if so, such changes in plans and estimates as may be necessary.

The information called for by Congress could be furnished only after a survey of the locality, which was made by Captain Carter who rendered a report under date of December 7, 1894, in which he submitted estimates amounting to $992,250 for extension of the Oyster Bed training wall and construction of a detached part parallel to the currents along the axis of the shoal between Tybee Roads and Calibogue Sound, these estimates being based upon the supposition that the entire amount would be available at one time.

This report was transmitted to Congress and printed in House Ex. Doc. No. 115, Fifty-third Congress, third session, and is reprinted in Appendix M 1 to this report.

July 1, 1894, balance unexpended		$250,000.00
Amount appropriated by sundry civil act approved August 18, 1894		975,000.00
Amount appropriated by sundry civil act approved March 2, 1895		856,250.00
Amount deposited by clerk of United States circuit court for southern district of Georgia		*500.00
		2,081,750.00
June 30, 1895, amount expended during fiscal year		1,428,120.01
July 1, 1895, balance unexpended		653,629.99
July 1, 1895, outstanding liabilities	$172,390.75	
July 1, 1895, amount covered by uncompleted contracts	426,351.03	
		598,741.78
July 1, 1895, balance available		54,888.21

(See Appendix M 1.)

2. Savannah River, Georgia.—The present project for the improvement of this river was adopted in 1890, the object being to secure a low-water steamboat channel, not less than 5 feet in depth, between the cities of Augusta and Savannah, Ga.

The estimated cost of the improvement is $332,000. Prior to improvement navigation was much impeded by logs, snags, piles, and other obstructions. The depth at summer low water over some of the shoals did not exceed 2 or 3 feet.

The total amount expended under the present project to June 30, 1894, including all outstanding liabilities, was $56,756.94, and resulted in removing 1,829 snags, stumps, and logs, and 12,208 overhanging

*Part of sum collected from a certain Spanish vessel for damage done Government property in Savannah Harbor, Georgia.

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trees from the most troublesome places throughout the whole extent of the river. Forty-two spur dams were constructed for the protection of caving banks below the city of Augusta and some of the old dams were repaired. There were placed in this work 12,093.44 cubic yards of brush fascines and 10,094.93 cubic yards of stone.

During the fiscal year just closed there were removed from the river 631 snags and stumps, 2,233 overhanging trees, and 1 sunken flatboat; 33 logs were cut up on bank and 959.75 cubic yards of material was dredged at Mother Peg Bar. In the construction of 26 spur dams at Canoe Cut Bar there were driven 956 piles, and 2,344 linear feet of pile work was wattled; there were also used in this work 3,880 square yards of brush mattresses, 1,430 cubic yards of brush fascines, and 192.50 cubic yards of riprap stone.

The total expenditures during the year just closed, including all outstanding liabilities, amounted to $15,706.53.

July 1, 1894, balance unexpended	$3,292.92
Amount appropriated by act of August 17, 1894	15,000.00
	18,292.92
June 30, 1895, amount expended during fiscal year	15,372.13
July 1, 1895, balance unexpended	2,920.79
July 1, 1895, outstanding liabilities	334.40
July 1, 1895, balance available	2,586.39

Amount (estimated) required for completion of existing project	257,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	17,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix M 2.)

3. Savannah River, above Augusta, Ga.—The present project for the improvement of this part of Savannah River is outlined in report of Capt. O. M. Carter, Corps of Engineers, dated January 31, 1890, and adopted in 1892. It contemplates the establishment of a pole-boat channel between Petersburg, Ga., and the Locks above Augusta, Ga., 12 to 25 feet wide and navigable at ordinary summer low water for boats drawing 2 feet. This is to be accomplished by the removal of sand shoals, ledges of rock or gravel, and overhanging trees and by the construction of spur dams and training walls to maintain the depth of the improved channel.

The estimated cost of the improvement is $33,000.

Prior to July 1, 1892, there was no work done under the present project.

The total amount expended under the present project up to June 30, 1894, including all outstanding liabilities, was $10,000, and resulted in the building of new dams and the repairing of old ones and the excavation of rock from the channel at various places. There were used in this work 2,018.66 cubic yards of fascines, 1,186.30 cubic yards of riprap stone, and there was excavated from the channel 341.5 cubic yards of rock, using 200 pounds of explosives.

During the fiscal year just closed there were removed from the river 85 cubic yards of loose rock, 16 snags, and 140 overhanging trees. There was also placed in the works of contraction built at various points 2,860.39 square yards of brush mattresses loaded with 1,310 cubic yards of riprap stone.

The expenditures during the fiscal year just closed amounted to $2,935.33.

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Amount appropriated by act of August 17, 1894	$6,000.00
June 30, 1895, amount expended during fiscal year	2,935.33
July 1, 1895, balance unexpended	3,064.67
Amount (estimated) required for completion of existing project	17,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	3,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix M 3.)

4. Darien Harbor, Georgia.—The plan of improvement under which operations have been carried on in Darien Harbor during the last fiscal year was adopted in 1885. The project contemplates the establishment of a navigable channel 12 feet deep at mean low water between Darien and Doboy. The mean rise and fall of tide is about 6.5 feet.

The estimated cost of the improvement is $170,000.

No work was ever done under the existing project prior to the fiscal year ending June 30, 1891.

The total expenditures under the present project of improvement to June 30, 1894, including all outstanding liabilities, amounted to $50,000, and resulted in the removal by dredging of 86,640.2 cubic yards of material from various shoals and in the construction of 20 spur dams of an aggregate length of 4,172.6 feet.

During the fiscal year just closed the existing spur dams were repaired and four additional ones constructed. There were placed in the pile dams 359 piles, 10,208.39 cubic yards of brush fascines, 683 cubic yards of riprap stone, 18,651 feet, B. M., of sawed timber, and 1,556.56 pounds of iron bolts. There was also placed at the heads of spur dams 286.66 square yards of brush mattresses, and there were driven 13⅜ clusters of fender piles, making a total of 400 piles driven in the work.

The total expenditures during the fiscal year just closed, including all outstanding liabilities, amounted to $25,000.

Amount appropriated by act of August 17, 1894	$25,000.00
June 30, 1895, amount expended during fiscal year	19,575.06
July 1, 1895, balance unexpended	5,424.94
July 1, 1895, outstanding liabilities	5,424.94
Amount (estimated) required for completion of existing project	95,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix M 4.)

5. Altamaha River, Georgia.—The plan of improvement under which operations have been carried on upon the Altamaha River during the last fiscal year was adopted in 1890.

The project contemplates the establishment of a steamboat channel 3 feet in depth at ordinary summer low water between Darien and the junction of the Oconee and Ocmulgee rivers.

The estimated cost of the improvement is $129,000.

Prior to improvement navigation was much impeded by logs, snags, and other obstructions, the low-water depths at some points not exceeding 2 feet.

The total amount expended under the present project to June 30, 1894, including all outstanding liabilities, was $29,529.88, and resulted in removing 1,083 snags and stumps and 7,319 overhanging trees; 31 logs were cut on bank. The snag boat also removed the wreck of the steamer *Tar Heel*, which was lying in the channel at Oswells Cut. At

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Beards Bluff 66 fender piles were driven and at Town Bluff Shoal 45 cubic yards of rock was removed from the channel. All this work was done by hired labor and purchase of material in open market.

At Beards Bluff 3,166 linear feet of wattled pile dam was built and at Marrowbone Bar 79 linear feet of shore protection. In this work there were used 482 piles, 2,462 square yards and 1,630 cubic yards of brush mattresses, and 371 cubic yards of riprap stone. All this work was done by hired labor and purchase of material in open market.

There were constructed at Couper Bar a training wall and three spur dams, aggregating 932 feet in length. This work was done by contract.

There were removed from the banks during the fiscal year just closed five overhanging trees. Under a contract the spur dams at Couper Bar were repaired, strengthened, and filled with brush fascines loaded with stone.

The total expenditures during the fiscal year just closed, including all outstanding liabilities, amounted to $10,693.53.

July 1, 1894, balance unexpended	$693.53
Amount appropriated by act of August 17, 1894	10,000.00
	10,693.53
June 30, 1895, amount expended during fiscal year	3,672.76
July 1, 1895, balance unexpended	7,020.77
July 1, 1895, outstanding liabilities	7,020.77
Amount (estimated) required for completion of existing project	89,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix M 5.)

6. Oconee River, Georgia.—The plan of improvement under which operations have been carried on upon the Oconee River during the last fiscal year was adopted in 1890.

The project contemplates the establishment of a steamboat channel, 3 feet in depth at ordinary summer low water, between Milledgeville, and the mouth of the river.

The estimated cost of the improvement is $171,000.

Prior to improvement navigation was much impeded by sand bars, overhanging trees, snags, and sunken logs. On some shoals there were low-water depths of not more than 2 feet.

Prior to July 1, 1894, there were removed from the channel, under the present project, 9,915 snags and stumps, 22,733 overhanging trees, and 366.5 cords of driftwood; 139 trees were girdled and 772 logs were cut up on bank. There was placed in the closing dam at Fish Trap Cut 600 cubic yards of stone. In building and repairing spur dams at Old Boat Yard there were driven 176 piles; 1,015 linear feet of piling was wattled with poles; and 1,011 linear feet of brush mattresses 18 feet wide, 40 cubic yards of brush, and 5 cubic yards of riprap stone were sunk; 13 snags and stumps were removed from the channel.

The total amount expended under the present project to June 30, 1894, including all outstanding liabilities, amounted to $49,366.84.

There were removed from the channel during the fiscal year just closed 592 snags and stumps and 2,183 overhanging trees; 96 trees were girdled, 24 logs were cut up on bank, and 560 pounds of explosives was used.

The total expenditures during the fiscal year just closed amounted to $4,813.22 and resulted in maintaining a navigable channel from the river's mouth to Milledgeville.

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July 1, 1894, balance unexpended	$930.59
Amount appropriated by act of August 17, 1894	10,000.00
	10,930.59
June 30, 1895, amount expended during fiscal year	4,813.22
July 1, 1895, balance unexpended	6,117.37
Amount (estimated) required for completion of existing project	111,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix M 6.)

7. *Ocmulgee River, Georgia.*—The plan of improvements under which operations have been carried on upon the Ocmulgee River during the last fiscal year was adopted in 1890. The project contemplates the establishment of a steamboat channel 3 feet in depth at ordinary summer low water between Macon and the mouth of the river.

The estimated cost of the improvement is $210,000.

Prior to improvement navigation was much impeded by rock shoals, sand bars, overhanging trees, snags, and sunken logs, the low-water depths at some places not exceeding 2 feet.

Prior to July 1, 1894, there were removed from the river under the present project 6,766 snags and stumps, 20,551 overhanging trees, 573 cubic yards of rock and loose bowlders, and the wrecks of three steamboats; 1,044 trees were girdled, 192 logs were cut up on bank, and 732½ pounds of explosives was used. Jetties and bank protection were built at Tillmans Bar. All this work was done by hired labor and purchase of material in open market.

The total expenditures under the present project up to June 30, 1894, including all outstanding liabilities, amounted to $54,169.28.

During the fiscal year just closed 290 snags and stumps and 3,788 overhanging trees have been removed, 38 logs were cut up on bank, and 127 pounds of explosives was used.

The total expenditures during the fiscal year just closed amounted to $5,979.10 and resulted in maintaining a navigable channel from the river's mouth to Macon.

July 1, 1894, balance unexpended	$1,075.67
Amount appropriated by act of August 17, 1894	10,000.00
	11,075.67
June 30, 1895, amount expended during fiscal year	5,979.10
July 1, 1895, balance unexpended	5,096.57
Amount (estimated) required for completion of existing project	145,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix M 7.)

8. *Brunswick Harbor, Georgia.*—The plan of improvement under which operations have been carried on in Brunswick Harbor during the last fiscal year was adopted in 1880 and modified and enlarged in 1886.

The project contemplates the establishment of a navigable channel not less than 15 feet deep at mean low water. The mean rise and fall of tide is 6.8 feet.

The cost of the project of 1880 was estimated at $73,187.50, and as enlarged in 1886 at $190,000, inclusive of appropriations already made.

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In 1880, prior to improvement, the channel was not more than 9 feet deep at mean low water.

The amount expended to June 30, 1894, including all outstanding liabilities, was $190,000, and has resulted in securing a navigable low-water channel not less than 15 feet deep.

During the fiscal year just closed there was put into the training wall 327.39 cubic yards of riprap stone. There was removed by dredging in front of the city 36,079.09 cubic yards of material.

The expenditures during the fiscal year ending June 30, 1895, including all outstanding liabilities, amounted to $10,000, and has resulted in maintaining the improvement.

Amount appropriated by act of August 17, 1894	$10,000.00
June 30, 1895, amount expended during fiscal year	8,830.58
July 1, 1895, balance unexpended	1,169.42
July 1, 1895, outstanding liabilities	1,169.42
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix M 8.)

9. Outer bar at Brunswick, Ga.—The act of Congress approved July 27, 1892, provided for payments to Mr. C. P. Goodyear, upon his procuring a channel of certain widths and depths, within periods specified, across the outer bar at Brunswick, Ga., north of the present channel, by the explosion of dynamite on or beneath the bottom of the channel. The examinations made by the local engineer showed that the depths required by the act to be obtained by November 1, 1892, and January 1, 1893, 22 and 23 feet, respectively, were not secured. By act of March 1, 1893, the time for procuring the various channel depths was extended to November 1, 1893. An examination made by the local engineer in November, 1893, showed that the depth of 22 feet required by the act to be obtained by November 1, 1893, had not been secured.

The river and harbor act of August 17, 1894, contained an item making appropriation of $30,000 to be paid Mr. Goodyear for depth of water theretofore obtained over said bar, and made provision for further payments to him upon his procurement of further depths within certain specified dates. The act also provided that no payments for further depths should be made to Mr. Goodyear except upon the certificate of a majority of a Board of Officers that the said C. P. Goodyear, his heirs and assigns, had complied with all the conditions named, the Board of Officers to consist of the Chief of the United States Coast and Geodetic Survey and two officers of the Corps of Engineers, to be detailed for the purpose by the Secretary of War. By paragraph 3, Special Orders, No. 267, Headquarters of the Army, Adjutant-General's Office, November 13, 1894, Maj. W. S. Stanton and Capt. F. V. Abbot, Corps of Engineers, were detailed to act as members of said Board, and reports of May 14 and August 17, 1895, by the Board as thus constituted are submitted. The Board states that at the dates of its reports Mr. Goodyear had not obtained a practicable channel at least 100 feet wide and 23 feet deep at ordinary mean high water.

(See Appendix M 9.)

10. Jekyl Creek, Georgia.—The plan of improvement under which operations have been carried on in Jekyl Creek during the last fiscal year was adopted in 1888. The project contemplates the establishment of a navigable channel through the creek 7 feet deep at mean low water. The mean rise and fall of the tide is about 7.1 feet.

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The contemplated improvement was estimated to cost $38,590.

Prior to improvement the low-water depth at some places did not exceed 3 feet.

The total amount expended to June 30, 1894, including all outstanding liabilities, was $35,000; of which $20,000 was provided by appropriations for the improvement of Jekyl Creek.

During the fiscal year just closed there were put into the training wall 10,616.43 square yards of brush mattresses and 1,873.27 cubic yards of riprap stone. There was removed by dredging 29,844.13 cubic yards of material, making a navigable depth of 7 feet at low water in the creek itself, as well as in its entrance.

The total expenditures during the fiscal year just closed, including all outstanding liabilities, amounted to $4,000.

Amount appropriated by act of August 17, 1894	$4,000.00
June 30, 1895, amount expended during fiscal year	1,091.43
July 1, 1895, balance unexpended	2,908.57
July 1, 1895, outstanding liabilities	2,908.57
Amount that can be profitably expended in fiscal year ending June 30, 1897, for maintenance. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	5,000.00

(See Appendix M 10.)

11. Cumberland Sound, Georgia.—The plan of improvement under which operations have been carried on at Cumberland Sound during the last fiscal year was adopted in 1879 and revised in 1891. The project contemplates the establishment of a navigable channel across the bar 19 feet deep at mean low water. The mean rise and fall of tide is 5.9 feet. The estimated cost of the improvement is $2,079,500, exclusive of the work done prior to 1891.

Prior to improvement the low-water depth of the entrance varied from 11 to 12.5 feet, with a mean rise and fall of tide of 5.9 feet.

The total amount expended under the present project up to June 30, 1894, including all outstanding liabilities, was $762,500.

During the fiscal year just closed there were put into the north jetty 213,334.11 square yards of brush mattresses and 18,748.33 cubic yards of riprap stone. This work was done by contract.

For the accommodation of the shipping of the port there was opened a gap in the south jetty. This work was done by hired labor.

The expenditures during the fiscal year just closed amounted to $170,000.

The navigable depth over the bar at present is 15 feet.

Amount appropriated by act of August 17, 1894	$170,000.00
June 30, 1895, amount expended during fiscal year	170,000.00
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	1,647,500.00

(See Appendix M 11.)

12. Inside water route between Savannah, Ga., and Fernandina, Fla.—The existing project of improvement, submitted in report of survey dated November 25, 1891, provides for the establishment of a channel 7 feet deep at mean low water between Savannah, Ga., and Fernandina, Fla.

The estimated cost of the improvement is $105,000, provided that amount may be made at once available.

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The sum of $35,000 has been appropriated, which has been expended at Jekyl Creek.

In its present condition the channel depth is less than 5 feet in some places.

The work has so far been entirely confined to the mouth of Jekyl Creek, where the depth across the bar now is 7 feet as against 4.08 feet before its improvement.

The total amount expended up to June 30, 1894, including all outstanding liabilities, was $15,000.

During the fiscal year just closed there were put into the training wall at Jekyl Creek 10,616.43 square yards of brush mattresses and 1,873.27 cubic yards of riprap stone. There was removed by dredging at Jekyl Creek 29,844.13 cubic yards of material.

The total expenditures during the fiscal year just closed, including all outstanding liabilities, amounted to $20,000.

Amount appropriated by act of August 17, 1894	$20,000.00
June 30, 1895, amount expended during fiscal year	6,426.41
July 1, 1895, balance unexpended	13,573.59
July 1, 1895, outstanding liabilities	13,573.59
Amount (estimated) required for completion of existing project	70,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix M 12.)

13. Removing sunken vessels or craft obstructing or endangering navigation.—The work of removing by hired labor four wrecks from Savannah Harbor has been completed during the fiscal year just closed. The total expenditures during the year for this purpose amounted to $2,181.03. An allotment has been made for the removal of an unknown wreck at the mouth of Rams Horn Creek, South Carolina, and the removal will be made during the next fiscal year.

(See Appendix M 13.)

SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The surveys of the following localities, required by the act of August 17, 1894, were made by the local engineer, Capt. O. M. Carter, Corps of Engineers, and reports thereon submitted through the division engineer, Col. William P. Craighill, Corps of Engineers:

1. Survey of Savannah River, Georgia, between Spirit Island and the point where the Charleston and Savannah Railroad crosses said river.—Captain Carter submitted report of survey November 23, 1894. He reports that operations are now being carried on for the improvement of this portion of the Savannah River under a project and estimate based upon detailed surveys made under his direction in 1889 and 1890. Reports of these surveys were submitted under date of June 30, 1890, and are printed in the Annual Report of the Chief of Engineers for 1890, pages 1259 and 1328 et seq. The report was transmitted to Congress and printed in House Ex. Doc. No. 56, Fifty-third Congress, third session. (See also Appendix M 14.)

2. Survey for steamboat channel, 7 feet deep at mean low water, between Beaufort, S. C., and Savannah, Ga.—Captain Carter submitted report of survey January 22, 1895. He states that no difficulties are experienced on that part of the route which lies between Beaufort and Rams Horn Creek, but in the latter creek and in Wrights River, notably in the

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mouth of each, there are a number of shoals carrying mean low-water depths of less than 7 feet. He submits two estimates for improvement of the waterway between Cooper River and Savannah, as follows:

Route No. 1: Rams Horn Creek, Wrights River, and Mud River	$84,700
Route No. 2: Rams Horn Creek and Wrights River	106,700

For reasons given route No. 2, although the longer and more expensive, is recommended by Captain Carter for improvement, at an estimated cost of $106,700, provided that sum is made available at one time, or at $150,000, if funds are provided in smaller amounts. The report was transmitted to Congress and printed in House Ex. Doc. No. 295, Fifty-third Congress, third session. (See also Appendix M 15.)

IMPROVEMENT OF RIVERS AND HARBORS IN FLORIDA.

This district was in the charge of Maj. Thomas H. Handbury, Corps of Engineers, with Lieut. Albert M. D'Armit, Corps of Engineers, under his immediate orders; Division Engineers, Col. William P. Craighill, Corps of Engineers, to May 18, 1895, and Lieut. Col. Peter C. Hains, Corps of Engineers, since that date.

1. St. Johns River, Florida.—Operations for the improvement of this river have been carried on in conformity with the project submitted in 1879, by the late Col. Q. A. Gillmore, Corps of Engineers. The plan contemplates the formation of a continuous channel, 15 feet deep at mean low water, from Jacksonville to the ocean. The points where work is required are in a reach near Dames Point, 12 miles from the mouth, and on the bar at the mouth. Near Dames Point the mean low-water depth varies from 12 to 13 feet, with a tidal range of about 2 feet. The bar at the mouth is formed of sand. Before work was begun the mean low-water channel depth across it varied from 5 to 7 feet, with a tidal range of 5.8 feet. The channel across the bar shifted continuously north and south through a mile range. The work was divided into two parts: (1) The formation of a channel across the bar at the mouth, by the concentration and direction of the tidal currents by two jetties to start from the opposite shores of the entrance, and to converge until on the bar their outer ends should be approximately parallel and 1,600 feet apart; and (2) the improvement of the Dames Point Reach by dredging, and the construction of works of protection, under a project approved June 11, 1891, and approved in a modified form March 28, 1892.

It was estimated that the cost of obtaining a channel over the bar 15 feet in depth at mean low water by this project would be $1,306,409, and for improving the river in accordance with the approved modified project, which contemplated a navigable channel having a depth at low water of 18 feet from inside the bar to Jacksonville, would be $324,000.

The aggregate of the appropriations made for this work since the adoption of the present project is $1,417,000, all of which has been made applicable to the improvement of the bar.

The amount expended up to June 30, 1894, was $1,177,796.48.

The act of July 13, 1892, authorized a contract to be made for the completion of the work at the mouth of the river, the amount of the contract not to exceed $397,000. The sundry civil act approved March 3, 1893, contained the item of $284,500 for completing the work.

The increased cost of the work over the original estimate is $110,591. This is attributable to the fact that for many years, during the early part of its progress, long and frequent intermissions were made necessary by reason of a want of adequate appropriations for carrying on a work of this magnitude. Under these circumstances favorable con-

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tracts could not be made, and the uncompleted work was subject to great deterioration during these suspensions.

From the year 1865 to the adoption of the project in 1879, a sum aggregating $57,476.38 had been expended in dredging for temporary improvement of the bar channel. For making preliminary surveys and preparing the project the sum of $2,523.74 was expended.

Operations during the year have been confined to the building of the south jetty under the contract entered into November 30, 1892, and to making surveys from time to time upon the bar at the mouth of the river.

The last delivery under the contract with I. H. Hathaway & Co. was made June 20, 1895, and the contract closed. The money value of the material received under it amounted to $364,461.23. The work is now completed so far as it can be under appropriations made and existing authority.

The total cost of the material, in place, used thus far in the construction of these jetties, including the spur dikes and other accessories that were found necessary in the course of their construction, was, north jetty, $380,185; south jetty, $821,059.

In the prosecution of this work there was expended by the Government for land, boats, and other plant in the neighborhood of $10,000. In 1891 about $2,000 was expended in dredging. The cost of engineering, office and other incidental expenses during the thirteen years prior to 1892 was 16⅝ per cent of the amount appropriated. During the three years since 1892, when funds were for the first time supplied for the work in amounts proportional to its importance, the expenses for these same items have been but a fraction over 8 per cent of the appropriations. This includes the small balance of the appropriation amounting to about $3,600 on hand for contingencies after settlement with the contractors. This clearly shows one of the disadvantages to the Government when funds for works of this character are not available as they can be profitably expended.

North jetty.—No work has been done upon this jetty since December, 1891. Its foundation at that time was out to station 10934. Its present condition is substantially as reported in last annual report.

South jetty.—This jetty was not extended any during the year, its outer end remaining as heretofore reported at station 10712. All the stone delivered during the year has been placed upon this jetty. At its outer end the stone has been piled to a height of 10 feet above mean low water, with the view to offering more resistance to the waves at that point and to allow for a greater settling. From this point inshore for a distance of 3,000 feet the crest of the jetty will average 2 feet above mean low water; thence for a distance of 2,400 feet its average height is 4 feet; thence for a distance of 1,000 feet it is about 3 feet below mean low water; thence for a distance of 3,000 feet it is practically 1 foot above; thence it slopes to extreme high water on the shore.

A great improvement in the channel depth would result from raising this jetty to mean high water throughout its entire length.

During the latter part of May and the early part of June a careful survey was made, covering the river from Mount Pleasant Creek down and out over bar to 36 feet depth of water. A comparison of the map made from this survey with the one that accompanied the last Annual Report shows that there has been a great change for the better, especially in the vicinity of the outer ends of the jetties. On the outer slope of the bar the 30-foot curve has advanced about 100 feet; the

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24-foot curve about 300 feet, and the 15 and 18 foot curves about the same distance. On the inside of the crest of the bar the 15-foot curve has advanced 1,000 feet, being a gain of 700 feet in the distance between this curve on the outside and inside of the bar. These curves are but 200 feet apart at a point near the end of the south jetty, and in the straight ship channel but 400 feet apart, with a depth of more than 14 feet intervening. Last year the greatest bar depth at mean low water was 11 feet; this year it is 14 feet, a gain of fully 3 feet.

The inside 18-foot curve has advanced 1,000 feet. This is also a gain of 700 feet on the distance which separated these curves on the outside and inside of the bar last year. The 24-foot curve has receded about 250 feet. All the other features of the comparison show favorable results for the jetties and warrant the assertion that they will be able to open a 15-foot channel at mean low water to the ocean.

Improvement of the river between the bar and Jacksonville, Fla.—The improvement of this reach of the river to the extent of giving a navigable channel throughout with a depth of 18 feet at mean low water was effected, as stated in the last Annual Report, by the citizens of Duval County, Fla., at a cost of $305,206.25. A critical examination made in January shows the dikes constructed to be in good condition and the depth of 18 feet or more to be maintained at all points where dredging was done. The survey just completed includes the lowest cut dredged by the Duval County commissioners. This shows that there has been a slight fill here in places, reducing the depth at low water to 16.5 and 17 feet. This cut is on a curve and has no protecting or training dike.

Under the authority granted in the river and harbor act which became a law August 17, 1894, a report, with plans and estimates, was submitted for continuing the work of improving the St. Johns River from Jacksonville to the ocean with the view to securing an increase of the depth of the channel to 24 feet. This report was printed as House Ex. Doc. No. 346, Fifth-third Congress, third session. It is also submitted herewith as Appendix N 22.

July 1, 1894, balance unexpended	$239,203.52
Deposited to credit of appropriation	.56
	239,204.08
June 30, 1895, amount expended during fiscal year	211,711.28
July 1, 1895, balance unexpended	27,492.80
July 1, 1895, amount covered by uncompleted contracts	23,870.46
July 1, 1895, balance available	3,622.34

(See Appendix N 1.)

2. Upper St. Johns River, Florida.—The reach of this river, which is included within the authorized project for its improvement, extends from the upper end of Lake George to the upper end of Lake Monroe. The difficulties to be overcome in order to improve navigation are the Volusia Bar, where the river enters or widens out into Lake George, for the improvement of which small appropriations have been made, and some short bends in the river. It does not appear that these curves form obstructions to navigation further than that the larger boats navigating the river have some difficulty in passing around them at full speed.

For the convenience of boats of the character mentioned a project for the improvement of these bends was submitted October 5, 1883. This contemplated dredging cut-off 100 feet wide at bottom, with a depth of 6 feet at low-water stages. The estimated cost was $38,800.

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An appropriation of $5,000 was made available for this work by the river and harbor act approved July 5, 1884. None has been made since. This appropriation was expended by dredging under contract between March 16 and October 14, 1893, at Wekiva and Coxcetters bends. The total amount of material removed was 11,400 cubic yards.

No work has been done since last annual report.

The amount expended to June 30, 1894, was $4,695.71.

July 1, 1894, balance unexpended	$304.29
July 1, 1895, balance unexpended	304.29
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	33,800.00

(See Appendix N 2.)

3. Volusia Bar, Florida.—Volusia Bar is located at the south end or head of Lake George, about 162 miles by river from the mouth of St. Johns River, at the point where the waters of the river flow into the lake. Before its improvement the channel over the bar was very crooked and had a least depth varying from 3½ to 4½ feet.

The approved project is to establish and maintain a channel 6 feet deep across the bar by the increased velocity of flow produced by two converging jetties of brush and stone, assisted by dredging if necessary, and to define and protect the channel thus formed by rows of fender piles.

In 1887 this project was modified to limit the depth to the 5 feet already attained, as that depth is sufficient for the steamers navigating the upper St. Johns River and is as great as can be carried over the bars between Lake Monroe and Lake George.

The total amount appropriated for this work is $28,000.

The amount expended up to June 30, 1894, was $26,766.59.

Two jetties have been built starting from opposite sides of the river bank at the south edge of the lake and converging until upon the bar they are 230 feet apart. The east jetty is 3,400 feet long and the west jetty 2,200 feet. They were built to the level of mean low water throughout nearly their entire lengths. Two rows of firmly set piles provided with waling pieces confine boats to a 100-foot channel across the crest of the bar. A total of 258 cubic yards of material was dredged from the bar in November, 1893, and some repairs were made to the fender piles.

The bar is gradually shoaling again and will from time to time need to be dredged. The piles and waling pieces also need some repairs. There is now scarce 5 feet over the bar at mean low water. The amount appropriated for repairs during the fiscal year ending June 30, 1896, has not yet been expended, but will be before the end of that year. An annual appropriation of $1,000 should be made for keeping this bar in a navigable condition.

July 1, 1894, balance unexpended	$233.41
Amount appropriated by act of August 17, 1894	1,000.00
July 1, 1895, balance unexpended	1,233.41
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	1,000.00

(See Appendix N 3.)

4. Ocklawaha River, Florida.—The portion of this river which it is proposed to improve lies between Leesburg, on Lake Griffin, and the

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mouth, a distance of 94 miles. The channel width varies from 30 to 70 feet and the depth from 5 to 9 feet. From the outlet of Lake Griffin, for a distance of 28 miles, the river is sluggish in current, has numerous bends, and is badly obstructed by floating islands and grass. For the remaining 58 miles the current is strong and the principal obstructions are snags and overhanging trees.

The project for the improvement of this river consists in removing snags, overhanging trees, floating islands, and other obstructions of like character, so as to give a fair navigable channel of 4 feet depth from the mouth to Leesburg, at the head of Lake Griffin, a distance of 94 miles. The estimated cost of this work is $26,000.

The total amount appropriated for this work is $14,000.

The amount expended up to June 30, 1894, was $11,000.

With this amount 4,455 snags and 1,017 overhanging trees were removed. This work was done with a Government outfit and hired labor. The result was to make the river fairly navigable for about 60 miles above its mouth. Beyond this point the principal obstructions are floating islands. The banks of that portion of this river that have been worked over are densely covered with all manner of semitropical vegetation. Trees are constantly falling into the river, forming new obstructions to navigation which must be removed.

During the last fiscal year no work was done upon the river. The Government plant with which this work has heretofore been done has been put in good repair and early in July will be sent to the field with a proper crew.

Amount appropriated by act of August 17, 1894	$3,000.00
June 30, 1895, amount expended during fiscal year	962.07
July 1, 1895, balance unexpended	2,037.93
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	12,000.00

(See Appendix N 4.)

5. St. Augustine Harbor, Florida.—The approved project is to protect the shores on the north and south side of the entrance from erosion, by groins constructed of riprap on brush foundation and capped with concrete.

The aggregate of the appropriations for this work is $71,000.

The amount expended up to June 30, 1894, was $64,917.54.

Work was commenced in 1889, and had resulted in the construction of 7 groins, 3 on the north beach, in length 549 feet, 467 feet, and 415 feet respectively; and 4 on the south beach, or Anastasia Island, near the light-house. These have lengths of 341 feet, 523½ feet, 290 feet, and 220 feet respectively. Where it has been found necessary to protect the roots of them from erosion wing walls have been built.

During the last two years the locality has been visited by very severe storms. These have had no marked effect upon the shore lines in this vicinity. The groins already constructed seem to have subserved the purpose for which they were designed, and it does not at present appear to be necessary, in the interests of commerce, to construct additional ones. The expenditure of the funds appropriated by the river and harbor act of August 17, 1894, has therefore been postponed until the necessity for additional work under this project is more fully developed. No estimate for the fiscal year ending June 30, 1897, is submitted.

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July 1, 1894, balance unexpended	$82.46
Amount appropriated by act of August 17, 1894	6,000.00
	6,082.46
June 30, 1895, amount expended during fiscal year	5.90
July 1, 1895, balance unexpended	6,076.56

(See Appendix N 5.)

6. Indian River, Florida, between Goat Creek and Jupiter Inlet.—The total length of this reach of the Indian River is 81 miles. Navigation was formerly interrupted by numerous shoals and bars having at low water a depth of from 2½ to 4 feet.

It was included in the franchise granted by the State of Florida to the Florida Coast Line Canal and Transportation Company, by which that company was authorized, in consideration of certain improvements to be made by it, to own vessels and navigate this waterway and to levy tolls upon its cuts and improved channels.

A survey and examination with estimate of the cost of the improvement of "Indian River between Titusville and Jupiter Inlet" was provided for in the river and harbor act of 1890.

The report made in compliance with this provision may be found in the Chief of Engineers' Report for 1891, page 1673 et seq. The project therein mentioned provides for making a continuous channel 5 feet deep at low water, and at least 75 feet wide in the straight reaches, with as much greater width in the turns as may be required, by widening the cuts of the canal company and making new cuts where needed, and by removing some of the mangroves in the Narrows. It was estimated that the work proposed would cost, approximately, $44,000.

Prior to this time the Florida Coast Line Canal and Transportation Company, under its charter from the State, dredged a number (23) of cuts across shoals within this reach, making a continuous navigable channel 50 feet wide and 5 feet deep. The aggregate length of these cuts is 39,500 feet.

By act approved July 13, 1892, $15,000 was appropriated for—

Improving Indian River, Florida, between Goat Creek and Jupiter Inlet: *Provided*, That no part of the money appropriated shall be expended until the Florida Coast Line Canal and Transportation Company surrenders and relinquishes to the United States all the rights and privileges which it now holds under State charter along the entire route.

After considerable delay these relinquishments were made in due form to the satisfaction of the United States Attorney-General, and work was commenced.

The work was done by a Government hydraulic dredge boat operated by hired labor. Actual dredging was commenced July 28, 1894, and continued until the end of January, 1895, at which time the $15,000 appropriated by the river and harbor act of 1892 for improving the Indian River between Goat Creek and Jupiter Inlet was exhausted.

There was removed in accordance with the project 56,665 cubic yards of material from localities as follows:

Long cut: Total length, 7,470 feet; 36,718 cubic yards.
High Bank Canal: Total length, 1,435 feet; 10,994 cubic yards.
Curved Canal: Total length, 1,900 feet; 7,700 cubic yards.
Conch Bar: Total length, 270 feet; 1,253 cubic yards.

At all these localities dredging had been done by the Florida Coast Line Canal and Transportation Company. The cuts were made 50 feet wide and to give 5 feet depth of water at the ordinary low stage. As a consequence of the passage of steamboats through them, and also of storms, the banks had tumbled and materially diminished the depth at

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many places. The operations of the Government dredge were directed to widening these cuts to 75 feet. The widened portions were given a depth of 6 feet to allow for back filling. The work done has been of great advantage to boats navigating the river.

The gross cost of this work was 26.4 cents per cubic yard.

In this connection the engineer officer in charge calls attention to the fact that the dredge with which this work was done is getting old and it will soon be necessary to replace it with a new one. A combination dredge and snag boat of this character with complete outfit ready for work would cost $40,000. The operating expenses would average about $1,500 per month. The small amounts appropriated for the improvement of the rivers and harbors in Florida, where dredging sand and shell and removing snags are the principal features of the work to be done, can be economically expended to great advantage to commerce in operating such a plant.

Negro Cut.—In response to a resolution of the United States Senate, dated October 17, 1893, a plan and estimate of "the cost of dredging a channel from the channel of the Indian River, of Florida, through the Negro Cut, to the bar at the Indian River Inlet, of the depth of 6 feet," was submitted December 4, 1893.* It was estimated that it would cost $32,775 to make this channel 100 feet wide and 6 feet deep. This estimate includes the cost of the training wall to give permanency to the dredged channel.

The river and harbor act which became a law August 17, 1894, contained an item for "improving Indian River, Florida, dredging channel from the channel of the Indian River through the Negro Cut to the bar at the Indian River Inlet, five thousand dollars, and, in addition thereto, the Secretary of War is hereby authorized to expend in making said improvement the fifteen thousand dollars appropriated for the improvement of Indian River by act approved July thirteenth, eighteen hundred and ninety-two."

The work of improving the river under the original project had been in progress for some time prior to the passage of this act. In consequence of its greater importance to navigation it was deemed advisable to continue the work already begun until the unexpended balance of the $15,000 was exhausted. The $5,000 not being sufficient for the expense of dredging the channel through the bar at Negro Cut, and there being a strong probability that this would fill up before work could be resumed if left incomplete, it was thought best to await an additional appropriation before commencing this work.

An appropriation of $15,000 was made for this work in the deficiency act of March 2, 1895. This, with the $5,000 already available, it is thought will be sufficient to dredge the channel through the bar.

Preparation is being made for commencing this work.

July 1, 1894, balance unexpended		$13,830.58
Amount appropriated by act of August 17, 1894	†$5,000.00	
Amount appropriated by deficiency act of March 2, 1895	†15,000.00	
		20,000.00
		33,830.58
June 30, 1895, amount expended during fiscal year		13,776.75
July 1, 1895, balance unexpended		†20,053.83

*Printed in Senate Ex. Doc. No. 3, Fifty-third Congress, second session; also in Annual Report, Chief of Engineers, 1894, pages 1227-1230.

†These amounts were appropriated for dredging channel from the channel of the Indian River through the Negro Cut to the bar at Indian River Inlet, and $20,000 of the balance unexpended July 1, 1895, is for that purpose.

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{Amount (estimated) required for completion of existing project..... $29,000.00
{Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.

(See Appendix N 6.)

7. Northwest Entrance, Key West Harbor, Florida.—The Florida Keys consist of a chain of rock and sand islands extending southwesterly from Cape Florida for nearly 200 miles. They are connected by extensive sand flats underlaid by rock, a soft oolitic limestone, from which the sand is almost entirely formed.

This chain is a barrier for all shipping from the Atlantic to the Gulf (eastern and middle) ports, and the straits between it and the West India Islands form a passage justly dreaded by mariners. It is crossed by four navigable channels—one between the Dry Tortugas, at the western extremity of the chain, and Rebecca Shoals, one east of Rebecca Shoals, the third (the Boca Grande Channel) 28 miles farther east, and the fourth (the northwest channel from Key West Harbor) immediately west of Key West, 85 miles east from the Dry Tortugas. It is this eastern position, combined with the good harbor at Key West at its extremity, which gives this channel its importance.

Vessels en route between Atlantic and Gulf ports which did not draw more than 10.5 feet of water in smooth weather made use of this passage. In rough weather this draft could not be carried through and such vessels were obliged to make use of one of the more westerly channels.

In the act of August 11, 1888, Congress appropriated $25,000 for this work, with the proviso that the Secretary of War should appoint a Board of three Engineer Officers, who should consider the subject and report on the advisability of continuing the work under the above project, and that he should submit the report, together with the views of himself thereon, to Congress at its next session. The Board was of opinion that the work is of national importance. It recommended that the improvement be begun by the immediate construction of a jetty on the northeast side of the entrance, to be probably supplemented as the work progresses by a jetty on the western side. The estimated cost of the first jetty was $500,000. The depth of water to be obtained is 17 feet.

The aggregate of the appropriations for this work amounts to $220,000.

The amount expended up to June 30, 1894, was $139,603.96.

With this amount the jetty now in process of construction has been completed for a distance of 3,800 feet. A farther distance of 7,564 feet is in a partially finished condition. During the last fiscal year there has been placed upon the jetty 16,336.5 tons of granite rock, in pieces weighing from 250 pounds to 6 tons.

Recent surveys show that the 12-foot channel reported in the last Annual Report has been maintained with slightly increased depth. The work done this year—that is, raising the jetty for a distance of 3,800 feet to the height of mean low water—has not yet had time to produce a noticeable effect upon this channel.

This channel is of very great importance both from a military and commercial point of view. When the improvement is completed in accordance with the project, it will afford a short cut for deep-draft vessels entering and departing from Key West for Gulf ports.

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July 1, 1894, balance unexpended		$396.04
Amount appropriated by act of August 17, 1894		80,000.00
		80,396.04
June 30, 1895, amount expended during fiscal year		57,734.06
July 1, 1895, balance unexpended		22,661.98
July 1, 1895, outstanding liabilities	$649.78	
July 1, 1895, amount covered by uncompleted contracts	14,504.65	
		15,154.43
July 1, 1895, balance available		7,507.55

Amount (estimated) required for completion of existing project	305,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	125,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix N 7.)

8. Caloosahatchee River, Florida.—Before improvement the lower part of the river was so obstructed by oyster bars that the available channel depth was only 5½ feet. About 17 miles above the mouth the river loses the characteristics of an estuary, and there are numerous islands and a broad shoal.

The project adopted in 1882 called for the formation by dredging of a channel 100 feet wide and 7 feet deep from the bay to Fort Myers, a distance of 17 miles. In 1886 this project was modified so as to include the improvement of the upper river as far as Fort Thompson by removal of snags and overhanging trees, giving a low-water depth of 4 feet for this reach.

The aggregate of the appropriations for this work amounts to $30,600. The amount expended up to June 30, 1894, was $28,592.63.

With the funds appropriated prior to 1894 the shoals below Myers were dredged to a depth of 7 feet and the channels across the bars marked with suitable piles. Above Myers the shoal at Beautiful Island was dredged to 4 feet and a dike or training wall built to concentrate the water through the dredged cut. A large number of snags have been removed from this portion of the river.

During the last year the U. S. snag and dredge boat *Suwanee* commenced snagging operations above Myers on the 25th of May. The field of operations extended as far up as Fort Thompson. Work was continued until the end of June, at which time all the available funds were exhausted. During this time 293 snags and 264 overhanging trees were removed.

There is now a clear channel from the mouth to Fort Myers having a low-water depth of 6 feet, and from there to Fort Thompson, 4 feet.

July 1, 1894, balance unexpended	$7.37
Amount appropriated by act of August 17, 1894	2,000.00
	2,007.37
June 30, 1895, amount expended during fiscal year	1,148.81
July 1, 1895, balance unexpended	858.56
July 1, 1895, outstanding liabilities	84.37
July 1, 1895, balance available	774.19

(See Appendix N 8.)

9. Charlotte Harbor and Pease Creek, Florida.—The river and harbor act approved September 19, 1890, contained an item for "improving, dredging and deepening the channel of Charlotte Harbor and Pease

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Creek, Florida, to the pier at Punta Gorda, the terminus of the Florida Southern Railroad, $35,000."

Under this appropriation a survey of the deep water of the harbor was made from Boca Grande Pass to Punta Gorda. There was found at that time a channel depth of 19 feet at mean low water on the bar at the Pass, 9 feet upon the shoals south of Cape Haze, and 10 feet upon the shoal near the wharves at Punta Gorda. The rise of tide is approximately about 2 feet. An estimate was made for dredging a channel 300 feet wide and 23 feet deep through the bar at Boca Grande Pass. The amount of this was $35,000. A separate estimate was made for forming a channel 200 feet wide and 12 feet deep from the wharves at Punta Gorda to the Pass. The amount of this was $127,500.

Work was inaugurated under the project for the 12-foot channel, estimated to cost $127,500, and the funds expended in dredging the channel near Punta Gorda wharves. The work thus far accomplished has resulted in forming a channel 300 feet wide for a distance of 300 feet in front of the wharves, 160 feet wide for a distance of 4,729 feet, and 120 feet wide for a distance of 1,764 feet, where it connects with the 12-foot contours.

The total length of the dredged cut is 6,793 feet. Over nearly the whole of this length the depth is in excess of 13 feet.

The amount expended up to June 30, 1894, was $34,650.70.

The river and harbor act of 1894 appropriated $20,000 for continuing this work. It was decided from a survey made in May, 1894, that this could be expended to best advantage in dredging on the shoals near Cape Haze and thence outward to Boca Grande Pass.

A contract was entered into for doing this work, and the actual work of dredging was commenced April 18, 1895. From that date to the end of the fiscal year 20,553 cubic yards has been removed.

With the funds now available it is expected to make a practical channel across these shoals 12 feet in depth; with future appropriations this can be widened.

It is estimated that $20,000 can be profitably expended upon this work during the fiscal year ending June 30, 1897.

July 1, 1894, balance unexpended		$349.30
Amount appropriated by act of August 17, 1894		20,000.00
		20,349.30
June 30, 1895, amount expended during fiscal year		2,903.16
July 1, 1895, balance unexpended		17,446.14
July 1, 1895, outstanding liabilities	$150.00	
July 1, 1895, amount covered by uncompleted contracts	15,104.60	
		15,254.60
July 1, 1895, balance available		2,191.54

Amount (estimated) required for completion of existing project 72,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897 20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix N 9.)

10. Sarasota Bay, Florida.—An examination and survey of the bay was made in 1889. An appropriation of $5,000 was made in the act approved September 19, 1890, for "improving Sarasota Bay from Tampa Bay to Sarasota, Fla."

A navigable channel, with a minimum depth of 5 feet, extends throughout the length of Big Sarasota Bay, excepting in two reaches, Palma Sola Pass and Long Bar, which have a total length of 5,400 feet.

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In these reaches the available depth was 4.3 and 3.5 feet, respectively. The tidal range in the bay is 1.5 feet.

The present approved project calls for the formation of a continuous channel, 100 feet wide and 5 feet deep at mean low water, from Tampa Bay to the town of Sarasota, Fla., a distance of 21¼ miles, at an estimated cost of $17,500.

The total amount appropriated for this work is $10,000.

With this amount dredging has been done with the Government dredge and hired labor upon Palma Sola Shoal, which has resulted in connecting the 5-foot contours by a cut 2,292 feet long, with a width of about 40 feet and a depth varying from 5 to 6 feet. The total amount dredged from this cut was 6,456.5 cubic yards; the material removed was sand and shells. Recent examination shows that the cut has not filled in. This work has been previously reported.

With the funds last appropriated dredging was done by the same means upon Long Bar, during last April and a part of May. A cut was dredged 4,500 feet in length, 50 feet wide to a depth of 5 feet at low water. There was 13,614 cubic yards of material removed.

These two shoals being dredged there is now practically the depth but not the width of channel called for by the project from Tampa Bay to Sarasota.

The amount expended upon this project to June 30, 1894, is $7,447.83.

July 1, 1894, balance unexpended	$52.17
Amount appropriated by act of August 17, 1894	2,500.00
	2,552.17
June 30, 1895, amount expended during fiscal year	2,523.60
July 1, 1895, balance unexpended	28.57
July 1, 1895, outstanding liabilities	27.00
July 1, 1895, balance available	1.57
Amount (estimated) required for completion of existing project	7,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	2,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix N 10.)

11. Manatee River, Florida.—Manatee River rises in the southern part of Florida and flows in a westerly direction, emptying into Tampa Bay on its southern shore. For a distance of 12 miles from its mouth it has the characteristics of an estuary.

Before improvement in the estuary the general depth of the river varied from 7 to 20 feet. At the mouth there was a long shoal, with a depth of 7 feet. Between Palmetto and Braiden Town there was another bar covered by from 3 to 5 feet of water.

An examination of Manatee River with a view to its improvement was made in 1881.

The original project, adopted in 1882, was for forming a channel 100 feet wide and 13 feet deep from Tampa Bay to Shaw and McNeils points. In 1887 the project was extended so as to cover the river as far up as Manatee, and give a depth of 8 feet at mean low water.

The amount expended to June 30, 1894, was $39,943.37.

The total amount appropriated for this work is $43,000.

An examination made in June, 1892, showed that the cuts made during and prior to 1890 had been well maintained, and that a clear channel 100 feet wide and from 8 to 9 feet deep existed over the entire length. At the same time an examination was made of the outer bar and of the bulkhead lying in the mouth of the river between Snead and Shaws points. It was found that an available channel depth of more than 9

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feet already existed on the outer bar, and that a cut through the bulkhead above referred to could be so located that advantage could be taken of the direction of the currents, so that its permanence would be reasonably assured. The steamboat men were very anxious to have this cut made, as it would materially shorten and straighten the channel and avoid the necessity of crossing a long stretch of water having a depth of only 8 feet. In view of these facts, it was decided to make a cut 100 feet wide and 12 feet deep at mean low water through the bulkhead at Snead Point. A cut at this point was adopted because of the immediate advantage it would give the trade of the river as far as Palmetto. The funds available did not warrant commencement of the work required on the outer bar. A channel was dredged 81 feet wide 12 feet deep through the bulkhead at Snead Point in 1893.

No work was done during the last fiscal year. With the amount last appropriated it is proposed during the coming year to widen and deepen the cuts already made through the shoals between Manatee and the mouth of the river.

July 1, 1894, balance unexpended	$56.63
Amount appropriated by act of August 17, 1894	3,000.00
	3,056.63
June 30, 1895, amount expended during fiscal year	56.63
July 1, 1895, balance unexpended	3,000.00
Amount (estimated) required for completion of existing project	30,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	1,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix N 11.)

12. Withlacoochee River, Florida.—The portion of this river which is included in the project for its improvement extends from its mouth in the Gulf of Mexico up to Pemberton Ferry, a distance of 77 miles.

The project adopted in 1879 is to improve the river by the removal of snags, overhanging trees, and loose rocks, and the deepening of some of the worst shoals and a bar at the mouth of the river, so as to enable boats drawing 2 feet to navigate the river during about one-half the year from the mouth to Hays Ferry, a distance of 71 miles. In 1886 the project was modified to permit the improvement to be continued as far as Pemberton Ferry, 6 miles from Hays Ferry.

The total amount appropriated for this work is $24,700. The amount expended to June 30, 1894, was $23,890.08.

The work was done partly by hired labor and partly by contract. The entire river from the mouth to Pemberton Ferry has been gone over and the worst obstructions removed.

At the close of operations the channel called for by the project had been formed between Pemberton Ferry and Dunnellon, though there are still obstructions which must be removed before navigation is safe.

There were no operations during the past fiscal year.

The channel is now practically clear and available for navigation for boats drawing 2 feet of water during one-half of the year.

The item in the river and harbor act of 1894, making appropriation for this river reads: "For maintenance, including a survey of the mouth of the river, eight hundred dollars." This amount, being entirely inadequate to defray the expenses of a survey which is assumed to have for its object the collection of data on which to base an estimate of the cost of improving the mouth of the river, has not yet been expended.

A description of this river, its needs in the way of improvement, and capabilities of future benefits to commerce is given in report of a pre-

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liminary examination made to comply with provisions of the river and harbor act of August 17, 1894, which was transmitted to Congress and printed in House Ex. Doc. No. 158, Fifty-third Congress, third session. The report is also submitted herewith as Appendix N 21.

July 1, 1894, balance unexpended	$9.92
Amount appropriated by act of August 17, 1894	800.00
July 1, 1895, balance unexpended	809.92

(See Appendix N 12.)

13. Suwanee River, Florida.—The project for the improvement of the Suwanee River was adopted in 1879. The reach of the river covered by the project extended from Ellaville to its mouth in the Gulf of Mexico, a distance of 130 miles. At that time the obstructions in this portion of the river consisted of shoals composed of soft unstratified limestone mixed with flint, extending partly or entirely across the river, in some instances covered with shallow deposits of sand and in others bare; also snags and overhanging trees. The channels across these shoals were often narrow and very crooked. Their depth at mean low water would vary from 15 inches to 3 feet. At places large isolated limestone bowlders in the channel were constant sources of danger to navigation.

An examination of the river with a view to its improvement was made in 1879. The estimated cost of the work to be done was $55,158.

The proposed improvement consists in deepening the bar at the passes by dredging, the removal of snags and overhanging trees along the river, and deepening and improving the channel at various places by the removal of rocks and snags and construction of wing dams, so as to straighten, widen, and deepen the channel. The depth to be obtained is 5 feet through the bars at the passes for a width of 150 feet and up the river as far as New Branford, a distance of 80 miles. From there to Ellaville, a distance of 50 miles, the depth is to be 4 feet and the width 60 feet.

The aggregate amount of the appropriations for this work is $47,000. Of this, $10,000 was authorized to be expended in the purchase or construction of a snag boat, with dredging and other machinery.

The amount expended up to June 30, 1894, was $43,965.30.

With this amount the boat has been constructed and a navigable depth of 5 feet at low water has been obtained from New Branford to the Gulf, and a depth of 3 feet at low water from New Branford up as far as Hudson, 10 miles below Ellaville.

No work was done during the last fiscal year. The amount appropriated by the river and harbor act of 1894 is still available and will be expended during the next year in defraying the operating expenses of the U. S. snag and dredge boat *Suwanee* while effecting the improvement of the river in accordance with the project.

July 1, 1894, balance unexpended	$34.70
Amount appropriated by act of August 17, 1894	3,000.00
	3,034.70
June 30, 1895, amount expended during fiscal year	172.67
July 1, 1895, balance unexpended	2,862.03
July 1, 1895, outstanding liabilities	22.84
July 1, 1895, balance available	2,839.19
Amount (estimated) required for completion of existing project	18,158.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	1,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix N 13.)

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14. Removing sunken vessels or craft obstructing or endangering navigation.—An obstruction to navigation in the Passage Key Channel to Tampa Bay having been reported, it was found, upon investigation, to be the wreck of a small steamer named *Millie Wales*. Her registered tonnage was 85.5 tons. She was burned while at anchor in this channel in January, 1885.

This wreck being an obstruction to navigation such as is contemplated by section 4 of the river and harbor act of June 14, 1880, steps have been taken to cause its removal under the provisions of that act.

Proposals were invited by advertisement for the removal of the wreck and opened June 28, 1895. (See Appendix N 14.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations and surveys of the following localities, required by the act of August 17, 1894, were made by the local engineer, Maj. Thomas H. Handbury, Corps of Engineers, and reports thereon submitted through the division engineer, Col. William P. Craighill, Corps of Engineers:

1. Preliminary examination of St. Johns River, Florida, at Orange Mills Flats, near Palatka, and for the improvement of the channel of St. Johns River to Sanford and points above.—Major Handbury submitted report of examination February 23, 1895. He states that, in view of the facts set forth, he is forced to the conclusion that neither the present nor prospective commerce of that portion of the St. Johns River lying above Jacksonville, Fla., will warrant its improvement by the General Government with a view to obtaining sufficient water for seagoing vessels, and his views are concurred in by the division engineer and by this office. The report was transmitted to Congress and printed in House Ex. Doc. No. 347, Fifty-third Congress, third session. (See also Appendix N 15.)

2. Preliminary examination of St. Lucia Inlet and River, Florida.—Major Handbury submitted report of examination December 15, 1894. It is his opinion and that of the division engineer, concurred in by this office, that these localities are worthy of improvement by the General Government. The surveys necessary for preparation of plan and estimate of cost of improvement will, it is estimated, cost $3,000. The report was transmitted to Congress and printed in House Ex. Doc. No. 159, Fifty-third Congress, third session. (See also Appendix N 16.)

3. Preliminary examination of entrance to Biscayne Bay, Florida.—Major Handbury submitted report of examination February 18, 1895. He is of opinion "that the present and prospective commerce of this locality is worthy of the fostering care of the General Government, and that the entrance at Bear Cut is worthy of improvement, provided that on further investigation, by surveys and borings to be taken on its bar, it does not appear that the cost will be excessive and out of proportion to the commerce to be benefited."

The division engineer considers, from the information available, that the locality is worthy of improvement by the General Government, though the results of a survey, which is recommended, might lead to an opposite conclusion, and his views are concurred in by this office. It is estimated that the survey necessary for the preparation of plan of improvement, with estimates, will cost $1,500. The report was transmitted to Congress and printed in House Ex. Doc. No. 343, Fifty-third Congress, third session. (See also Appendix N 17.)

4. Preliminary examination of Tampa Bay, Florida, from Port Tampa to the mouth of the bay.—Major Handbury submitted report of examina-

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tion December 28, 1894. In his opinion, concurred in by the division engineer and by this office, Tampa Bay is worthy of improvement by the General Government. It is estimated that the surveys necessary to the preparation of plan of improvement, with estimates, will cost $3,500. The report was transmitted to Congress and printed in House Ex. Doc. No. 194, Fifty-third Congress, third session. (See also Appendix N 18.)

5. *Preliminary examination of Anclote River, Florida.*—Major Handbury submitted report of examination December 21, 1894. It is his opinion and that of the division engineer, concurred in by this office, that the locality is worthy of improvement by the General Government. It is estimated that the survey necessary for preparation of plan of improvement, with estimates, will cost $800. The report was transmitted to Congress and printed in House Ex. Doc. No. 160, Fifty-third Congress, third session. (See also Appendix N 19.)

6. *Preliminary examination of Crystal River, Florida, at its mouth.*—Major Handbury submitted report of examination December 22, 1894. It is his opinion and that of the division engineer, concurred in by this office, that the locality is not at this time worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 157, Fifty-third Congress, third session. (See also Appendix N 20.)

7. *Preliminary examination of Withlacoochee River, Florida, from its mouth to head of navigation.*—Major Handbury submitted report of examination December 20, 1894. It is his opinion, concurred in by the division engineer and by this office, that the locality is worthy of further improvement by the General Government. It is estimated that the serveys necessary to preparation of plan of improvement, with estimates, will cost $5,000. The report was transmitted to Congress and printed in House Ex. Doc. No. 158, Fifty-third Congress, third session. (See also Appendix N 21.)

8. *Survey of St. Johns River, from Jacksonville to the ocean.*—Major Handbury submitted report of survey February 18, 1895. The plan submitted by him contemplates the dredging of a channel 300 feet wide and 24 feet deep through the shoals and the construction of training dikes in the river proper at the localities mentioned, at an estimated cost of $600,000; also the extension of the present north and south jetties at the mouth 1,500 feet and 500 feet, respectively, and the raising of these jetties throughout their entire lengths to the heigth of mean high water to secure a depth of 24 feet over the bar, at an estimated cost of $1,509,750; in all, $2,109,750.

The division engineer forwards the report recommended for approval, subject to such modifications in detail as experience in the progress of the work will almost surely show to be expedient or necessary for economical and successful results, and states that a strong guarantee of the prompt success would be the assured supply of money as rapidly as it can be judiciously used. He further states that the commercial interests involved amply justify such an expenditure of money as the estimates call for. The report was transmitted to Congress and printed in House Ex. Doc. No. 346, Fifty-third Congress, third session. (See also Appendix N 22.)

9. *Survey of harbor at Cape Canaveral, Florida.*—Major Handbury submitted report of survey February 11, 1895. He states that there is no improvement worthy of the serious consideration of the General Government that can be made in this locality other than the construction of a breakwater to protect vessels from the violence of storms;

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and he estimates that a breakwater 2½ miles in length, located as shown on the map* submitted, will cost $7,460,970.

He also submits a plan for protection of a smaller area, which might accommodate 25 first-class vessels and 500 small coasting vessels, and estimates the cost of this structure at $4,091,010. Such a refuge, he remarks, considering the expense involved, would be very unsatisfactory. The report was transmitted to Congress and printed in House Ex. Doc. No. 321, Fifty-third Congress, third session. (See also Appendix N 23.)

IMPROVEMENT OF RIVERS AND HARBORS IN WESTERN GEORGIA AND FLORIDA AND IN EASTERN ALABAMA.

This district was in the charge of Maj. F. A. Mahan, Corps of Engineers, having under his immediate orders Lieut. Charles Keller, Corps of Engineers, to July 15, 1894, and Lieut. Charles P. Echols, Corps of Engineers, since July 12, 1894. Division Engineers, Col. C. B. Comstock, Corps of Engineers, to February 3, 1895, and Col. H. M. Robert, Corps of Engineers, since February 5, 1895.

1. Apalachicola Bay, Florida.—In 1879 there was a minimum depth of 3.5 feet in the channel over the bar at the mouth of the Apalachicola River.

The bar begins about one-half mile below the town of Apalachicola, Fla., and is about 7,300 feet wide between the 8-foot curves.

In 1879 a plan of improvement was adopted which contemplated dredging through the bar a straight channel 11 feet deep and 100 feet wide, to be afterwards increased to 200 feet should the first cut produce results to warrant it.

In 1891 this project was amended to include dredging a straight channel through Bulkhead Shoal 9 feet deep and not less than 100 feet wide.

Up to June 30, 1893, the sum of $126,828.61 had been expended on this improvement in dredging a straight channel through the bar at the mouth of the Apalachicola River at various times since 1881, and in dredging a channel about 4,000 feet long, 120 feet wide, and 9 feet in depth across the Bulkhead Shoal in 1891-92. With the appropriations available the dredged cut through the bar had never exceeded 90 feet in width and 9.5 feet in depth, and had gradually filled up after each dredging, partly by the deposit of silt from the river and partly by the washing in of material from the sides of the cut. Between November, 1892, and April, 1893, a cut 5,600 feet long, from 70 to 120 feet wide, and 8 feet deep was made through the bar at the mouth of the Apalachicola River.

No change in the cut through Bulkhead Shoal is reported. This shows, apparently, that this channel is fairly permanent. Longer experience shows that dredging to the amount of 60,000 or 70,000 cubic yards will be required every year to keep open the bar at the mouth of the Apalachicola River. A wider and deeper channel, which could be had for about $50,000, might be more permanent.

A contract for reopening the channel through the bar at the mouth of the river has been made at the price of 24 cents per cubic yard.

The commerce at Apalachicola Bay consists mainly in the exportation of lumber and naval stores, which are transported from the mainland to the anchorage grounds in lighters and rafts towed by tugs, drawing from 5 to 7 feet of water. When the depth in the channel across the bar at the mouth of the river is reduced below 7 feet much trouble is experienced in carrying on the business of the port.

* Omitted; printed in House Ex. Doc. No. 321, Fifty-third Congress, third session.

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July 1, 1894, balance unexpended		$91.81
Amount appropriated by act of August 17, 1894		15,000.00
		15,091.81
June 30, 1895, amount expended during fiscal year		295.20
July 1, 1895, balance unexpended		14,796.61
July 1, 1895, outstanding liabilities	$49.70	
July 1, 1895, amount covered by uncompleted contracts	13,000.00	
		13,049.70
July 1, 1895, balance available		1,746.91
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		15,000.00

(See Appendix O 1.)

2. Apalachicola River, the Cut-off, and Lower Chipola River, Florida.—The examination and survey of the Apalachicola River, finished in 1873, showed that the river, throughout its length of 105 miles, had a channel not less than 6 feet deep. The channel was, however, much obstructed by the accumulation of logs and snags brought into it by the freshets in the Chattahoochee and Flint rivers and by the trees which had fallen from its own heavily timbered banks. At Moccasin Slough the river had been obstructed by piles driven by Confederate authorities during the war. Drift had accumulated against these piles, forming a dam across the river, which had then forced a narrow and very crooked channel through its banks and into the river Styx. Navigation was difficult at the upper and lower Elbows on account of the abrupt bends and narrow channel.

The original project for the improvement of the river provided for securing a channel 100 feet wide and 6 feet deep, by the removal of snags and overhanging trees and widening and straightening the channel at Moccasin Slough and the Elbows, at an estimated cost of $80,333.

In conformity with the act of September 19, 1890, this project was in that year modified by adding thereto the securing of a channel 60 feet wide and 5 feet deep through the Cut-off, Lee Slough, and the lower Chipola River, at an estimated cost of $7,500.

The expenditure between 1874 and June 30, 1895, of $53,257.11 has resulted in clearing out the great accumulation of logs and snags and overhanging trees which originally obstructed the Apalachicola River and in annually removing the new logs and snags brought in by the winter freshets.

Between 1874 and 1880 the accumulation of logs and snags was removed from the channel of the river and a partial improvement was made at Moccasin Slough and the Elbows. The appropriations since 1880 have been just sufficient to remove the snags and logs brought down every year by the spring freshets.

Many snags, sunken logs, and overhanging trees have been removed from the Apalachicola River, the Cut-off, and Lower Chipola River during the past three years. Steamboats can pass now with some difficulty through the Cut-off, Lee Slough, and Lower Chipola River on the upstream passage. These waterways afforded the only practicable means of transportation for the products of this section of country, which is being rapidly settled by fruit growers, and it is very desirable that a sufficient appropriation shall be made to enable a safe channel to be opened through Lee Slough.

The work of the past fiscal year has been confined to the removal of snags, logs, trees, and bushes.

The sum of $9,000 will complete the work of putting this stream in good order.

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The Cut-off is a navigable waterway about 3 miles long, connecting the Apalachicola River with the Lower Chipola River near the Dead Lakes. The Chipola River empties into the Apalachicola River about 14 miles below its junction with the Cut-off. "Lee Slough" is simply a local name for a portion of the Lower Chipola River, about 3 miles long. (See map at page 1697 of the Annual Report of the Chief of Engineers for 1891.) It is therefore suggested that the wording of the next appropriation for this river be changed from "Apalachicola River, Florida, including the Cut-off, Lee Slough, and Lower Chipola River," to "Apalachicola River, Florida, including the Cut-off and Lower Chipola River," in order that the work required to be done may be correctly designated.

Amount appropriated by act of August 17, 1894	$5,000.00
June 30, 1895, amount expended during fiscal year	3,691.81
July 1, 1895, balance unexpended	1,308.19
July 1, 1895, outstanding liabilities	1,027.13
July 1, 1895, balance available	281.06
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	5,000.00

(See Appendix O 2.)

3. Flint River, Georgia.—Before the improvement was begun the river was only navigable at low water from its junction with the Chattahoochee River up to Bainbridge, and the channel over this portion was narrow, crooked, and much obstructed by logs, snags, and overhanging trees.

The present project for the improvement of this river was adopted in 1873 and modified in 1879, the object of the original project being to afford a channel 100 feet wide and 3 feet deep at low water from its mouth up to Albany, Ga., an estimated distance of 105 miles, and of the modification to provide a navigable channel for light-draft steamers at moderate stages of water from Albany to Montezuma, an estimated distance of 77 miles.

Previous to the act of June 18, 1878, $70,000 was appropriated for the "Chattahooche and Flint rivers," of which $18,000 was expended on the Flint River.

The expenditure to June 30, 1895, is $192,216.91.

Above Albany the channel had been partially cleared of logs and snags and overhanging trees, and to a limited extent of loose rock.

Below Albany some loose rock excavation had been done at all the shoals between Albany and Bainbridge. There was a completed and permanent channel from Albany to Newton, 33¼ miles. From Newton to Bainbridge, 21 miles, the channel was passable, with care, at moderate stages of water, but it was impracticable at many places during low water. From Bainbridge to the mouth of the river, 36 miles, the river was navigable throughout the year, and required but little improvement aside from the removal of drift logs and snags brought in by the winter floods.

Between the mouth of the river and Bainbridge, Ga., an estimated distance of 36 miles, the river is in fairly good condition and requires little more than the annual clearing of snags and drift brought in by the winter freshets. On this portion of the river many steamboats plying on the Chattahoochee and Apalachicola rivers make regular trips and do a large business, and the maintenance of the navigation is therefore of great commercial benefit.

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Between Bainbridge and Albany, Ga., an estimated distance of 65 miles, the improvement consists mainly in excavating a channel through the many rock shoals and reefs and in depositing the excavated material in spur dams. The improvement, when completed, will be of a permanent character, but for its preservation and for the annual removal of the snags and drift it will be necessary to maintain a snag boat on the river, at an estimated cost of $6,000. A considerable river trade had been developed on this section of the river in consequence of the improvements already effected. The business will probably be much increased as low-water navigation is facilitated by further work.

Above Albany for a distance of 38 miles, to Warwick, Ga., low-water navigation is prevented by a series of rock shoals on which the low-water depth varies from 6 to 18 inches. The loose bowlders have been partially removed from the channel on this portion of the river. Experience in the work shows that a practicable and useful navigation of this portion of the river at moderate stages of water can probably be secured only by providing slack-water navigation by the construction of locks and dams at great expense.

Between Warwick and Montezuma, an estimated distance of 39 miles, the improvement consists mainly in the removal of logs and drift and overhanging trees, and has been sufficiently accomplished to permit navigation at moderate stages of water, but no commercial use has been made of this section of the river since July, 1890, when the Montezuma Steamboat Company disposed of their small steamer. It is not believed that any commercial benefit has since been derived from continuing the improvement of the Flint River above Albany. Two bridges, without draw openings, at distances, respectively, of 16 and 41 miles above Albany, obstruct steamboat navigation, but no measures have been taken to require the owners of the bridges to provide them with draw openings for the reason that no complaints have been made against them.

It is useless to continue the improvement above Albany for commercial purposes unless these bridges are provided with draw openings, and it seems to be an unnecessary hardship to compel the owners to provide draw openings to accommodate a commerce which does not now exist and of which there is no immediate prospect. For this reason, and on account of the improbability of being able to secure a satisfactory navigation without construction of locks and dams at a cost entirely incommensurate with any prospective commerce to be developed thereby, it is recommended that no further allotments be made, for the present at least, for the improvement of the Flint River above Albany, but that the whole appropriation be expended in continuing the useful and important work below Albany.

Work during the fiscal year ending June 30, 1895, has been confined to repairs of the plant and to work on the rock shoals near Newton, Ga.

July 1, 1894, balance unexpended	$2,046.07
Amount appropriated by act of August 17, 1894	8,000.00
	10,046.07
June 30, 1895, amount expended during fiscal year	4,232.97
July 1, 1895, balance unexpended	5,813.10
July 1, 1895, outstanding liabilities	748.94
July 1, 1895, balance available	5,064.16
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	8,000.00

(See Appendix O 3.)

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4. Chattahoochee River, Georgia and Alabama.—The river was originally much obstructed by logs, snags, and overhanging trees and by a number of rock and marl shoals and sand bars, so that navigation was difficult and dangerous. Steamboats could only run by daylight, and not unfrequently lay for weeks at a time awaiting a rise in the river. Very many were sunk by striking obstructions.

The present plan of improvement, adopted in 1873 and modified in 1882, contemplates a low-water channel 4 feet in depth and 100 feet in width from Columbus, Ga., to Chattahoochee, Fla., a distance of 224 miles, by the removal of snags and other obstructions from the channel and overhanging trees from the banks, by the excavation of rock shoals, and by works of contraction and shore protection.

Previous to the act of June 18, 1878, $70,000 was appropriated for the "Chattahoochee and Flint rivers," of which $52,000 was expended on the Chattahoochee River.

The result of expending $276,715.99 up to June 30, 1895, was to give a low-water channel, nearly free from obstructions, below Eufaula, Ala. Boats drawing less than 3½ feet have but little difficulty. Between Eufaula, Ala., and Columbus, Ga., the channel was still obstructed by sand and gravel bars, especially at Hospital Reach, Woolfolk, Shell Creek, and St. Francis bends.

If sufficiently large appropriations were made to improve these localities by substantial works, it is believed that thereafter the navigation of the river could be maintained in good condition throughout the year by annual appropriations of $10,000 for the operation of an efficient snag boat and for the maintenance of the contraction and shore-protection works.

Repairs sufficient to make the pile driver barge and one of the flatboats last through the present season were done. Both these vessels are rotten in hull and should be rebuilt. This can be done for $5,000.

July 1, 1894, balance unexpended	$1,106.80
Amount appropriated by act of August 17, 1894	25,000.00
	26,106.80
June 30, 1895, amount expended during fiscal year	12,804.58
July 1, 1895, balance unexpended	13,302.22
July 1, 1895, outstanding liabilities	418.50
July 1, 1895, balance available	12,883.70
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	20,000.00

Between West Point and Franklin.—This section of 38 miles of the river consists of a series of pools, varying in length from one-half to 5 or 6 miles and separated by rock shoals and rapids, in some of which the fall is as great as 8 feet to the mile. In the pools the width of the river is from 300 to 500 feet, with a channel nowhere less than 4 feet deep. At the shoals the river is much wider, with numerous islands and low-water depths in many places of only a few inches. The bottom is generally of rock and the banks are stable. There are few, if any, sand or gravel bars and but few snags.

The river and harbor act of September 19, 1890, provided for a preliminary examination of the Chattahoochee River between West Point and Franklin. This examination was made in November, 1890, and reports of the results are printed at page 1756 of the Report of the Chief of Engineers for 1891.

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The river and harbor act of July 13, 1892, provided for "improving Chattahoochee River, Georgia and Alabama: Continuing improvement, twenty-five thousand dollars, of which five thousand dollars are to be used on that portion of the river between West Point and Franklin."

Five thousand dollars was allotted also in the river and harbor act of August 17, 1894.

The project for the improvement of this section of the river, submitted July 26, 1892, and approved August 4, 1892, contemplates the removal of the lesser rock shoals, sand and gravel bars by excavation and by works of contraction, removal of overhanging trees from the banks, and snags, logs, and other obstructions from the channel, and the construction of locks and dams to overcome the more serious obstructions, to give a minimum depth of 3 feet at low water in the channel between West Point and Franklin, a distance of 38 miles.

Up to June 30, 1895, $6,438.38 had been expended in procuring the necessary plant, in rock excavation at certain of the shoals above West Point and in depositing the excavated material in training dams, and in making a survey for a short canal and lock around the 6-foot mill-dam at Bentley Mill.

A channel 50 feet wide and 3 feet deep has been obtained through Flat Rock Shoals and Roberts Shoals. A similar channel was begun at Haynes Island Shoals; it was not finished at the close of the year.

When the work at Haynes Island Shoals shall have been completed nothing further can be done on this part of the stream except at a cost which the traffic of the stream does not justify. No estimate is submitted for the year ending June 30, 1897.

July 1, 1894, balance unexpended	$94.67
Amount appropriated by act of August 17, 1894	5,000.00
	5,094.67
June 30, 1895, amount expended during fiscal year	1,533.05
July 1, 1895, balance unexpended	3,561.62

(See Appendix O 4.)

5. *Choctawhatchee River, Florida and Alabama.*—When work on the improvement was begun, in 1874, the river, notwithstanding the average width of 300 feet, was almost totally obstructed by the accumulation of logs and snags, and navigation was only possible by flatboats of light draft. The channel, if a channel existed at all, was exceedingly dangerous to navigation, particularly during the lower stages of water.

The project for improvement adopted in 1880 was for obtaining a low-water navigable channel from its mouth to Geneva, Ala., an estimated distance of 125 miles, and a navigable high-water channel from Geneva, Ala., to Newton, Ala., an estimated distance of 37 miles.

In 1890 the project was amended to provide for securing a low-water channel from Geneva to Newton.

The improvement consists in the removal of logs, in deepening sand bars by works of contraction and shore protection, and in excavating a channel through the rock and marl shoals.

The expenditure up to June 30, 1895, of $123,897.02 has resulted in removing the obstructions from the river, between its mouth and Caryville, sufficiently to meet the requirements of the present commerce on that section of the river, in giving a fairly navigable channel, except at extreme low water, from the crossing of the Pensacola and Atlantic Railroad at Caryville, Fla., to Geneva, Ala., and a partially improved channel from Geneva to Pate Landing, 25 miles above, and in provid-

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ing a plant for carrying on works of contraction and shore protection at the troublesome bars. Some of these were applied at Buzzard Bar, Gunfield Shoals, and Busby Shoals, with such successful results that boats have experienced no trouble since then in passing them.

Steamboats run now quite regularly from Geneva, Ala., to the railroad at Caryville.

During the fiscal year ending June 30, 1895, $3,960.96 was expended in repairs to the snag boat and in snagging.

Boats carrying large amounts of freight have little or no difficulty in running on this stream either by day or by night.

Geneva is a thriving town, the trading and shipping center for a rich agricultural region surrounding it. The river affords the only practicable means of transportation to this district. During recent years the work has, therefore, mainly been directed to improving this section of the river, and has resulted in clearing out a large number of the accumulated logs and snags. Low-water navigation is impeded by several sand bars, which can be readily deepened by works of contraction and shore protection if sufficient funds are appropriated for the purpose.

When freight offers steamboats occasionally run to Pate Landing at favorable stages of water.

Since the completion of the Alabama Midland Railroad from Montgomery, Ala., to Bainbridge, Ga., which passes through Newton, the urgent necessity for improving the upper portion of the river no longer exists, and it is doubtful if this section would now be much used even if the improvements were completed.

The plan, therefore, contemplates completing the improvement between Geneva and Caryville, and then between Geneva and Pate Landing before beginning any work upon the marl shoals which now obstruct navigation between Newton and Pate Landing. It is very doubtful whether a safe low-water navigation of this section of the river can be secured except by the construction of locks and dams to provide slack-water navigation, at a cost not warranted by any prospective commerce to be developed thereby.

July 1, 1894, balance unexpended	$2,063.94
Amount appropriated by act of August 17, 1894	6,000.00
	8,063.94
June 30, 1895, amount expended during fiscal year	3,960.96
July 1, 1895, balance unexpended	4,102.98
July 1, 1895, outstanding liabilities	587.59
July 1, 1895, balance available	3,515.39
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	6,000.00

(See Appendix O 5.)

6. Harbor at Pensacola, Fla.—In 1878 the channel was much obstructed by wrecks, and a survey made in 1879 showed that the inner bar had shoaled to a least depth of 19.5 feet at mean low water. This depth was not sufficient to accommodate the large number of vessels seeking entrance to the port. The western shore of the entrance to the harbor, which is the site of old Fort McRee, was fast washing away and a large portion of the fort had disappeared. Corresponding changes in the direction of the channel and of the tidal currents had occurred, and to this was attributed the shoaling of the inner bar. The removal of the wrecks was begun in 1878.

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The plan of improvement adopted in 1881, in accordance with the report of The Board of Engineers, contemplated dredging a channel 300 feet wide and 24 feet deep at mean low water across the inner bar, for the temporary relief of the navigation of the harbor, and protecting the shore line near Fort McRee from further abrasion, with the view of preventing injurious changes in the tidal currents and retaining this position for defensive purposes.

A channel 120 feet wide and 24 feet deep at mean low water was the result of dredging done in 1886. This channel filled up so that in June, 1891, it was only 19 feet deep. It was then dredged out again to a least depth of 20.5 feet, but this depth was reduced to 19.2 feet in November, 1892.

Two groins, built near the site of Fort McRee, stopped further abrasion of the shore line. They were 360 and 220 feet long, respectively. They were finished in April, 1890.

Up to June 30, 1895, $353,021.50 had been expended on the improvement of this harbor.

The dredging done during May, June, July, and August, 1893, gave a channel 1,400 feet long, 225 feet wide, and 24 feet deep across the inner bar. On June 30, 1894, the channel was reported 19.5 feet deep. On June 26, 1895, it is reported as 20.45 feet. These are the least depths found for navigation.

On January 17, 1891, a Board of Engineers was appointed to assemble at Pensacola, Fla., for the purpose of considering and reporting upon the improvement of the harbor. The report of the Board, dated July 16, 1891, is printed in the Annual Report of the Chief of Engineers for 1891, page 1723. The proposed method of securing a permanent deep channel at the entrance to Pensacola Harbor is by means of two jetties, starting from the shores near Forts Pickens and McRee, respectively, at an estimated cost of $1,830,000, assisted by such dredging as may be required.

July 1, 1894, balance unexpended	$2,523.32
Amount appropriated by act of August 17, 1894	100,000.00
	102,523.32
June 30, 1895, amount expended during fiscal year	5,544.82
July 1, 1895, balance unexpended	96,978.50
July 1, 1895, outstanding liabilities	452.73
July 1, 1895, balance available	96,525.77
Amount that can be profitably expended in fiscal year ending June 30, 1897	500,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix O 6.)

7. *Escambia and Conecuh rivers, Florida and Alabama.*—These rivers are really one river, that portion of the river from its head waters in south Alabama to the Florida and Alabama State line being called the Conecuh River and the portion in Florida, 61 miles long, being called the Escambia River. It empties into Escambia Bay. Fully 60 per cent of the immense quantity of timber shipped from Pensacola Harbor is cut on lands tributary to the Escambia River and floated down in rafts to Pensacola Harbor.

The river originally was much obstructed by snags, sunken logs, and rock shoals and by a very shoal bar at the mouth. Steamboat navigation was not attempted and rafts had much difficulty in passing down the river.

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The plan of improvement for this river, adopted pursuant to examinations and surveys made in 1878, contemplates the removal of snags, sunken logs, and other obstructions from the channel, cutting through the rock shoals and deepening sand bars by works of contraction and shore protection from the mouth of the river, in Pensacola Bay, to the mouth of Indian Creek, an estimated distance of 293 miles, for the purpose of facilitating the movement of saw logs and timber down the river, affording at the same time facilities for steamboat navigation.

The expenditures made on this river up to June 30, 1895, amount to $76,076.01. Their result has been the providing, maintaining, repairing, and renewing of the necessary plant; dredging twice through the bar at the mouth of the river to let tugs pass drawing 5 feet; removing large quantities of logs and snags from the mouth to Jordan Shoals, a distance of 136 miles; keeping the improved channel free from logs and snags. At the end of 1893 the river was in such condition that rafts could run safely on stages of water above 2 feet for a distance of 106 miles from the mouth.

During the fiscal year ending June 30, 1895, the operations of previous years were continued, and the condition of the river was further improved.

This river and its tributaries pass through the extensive timber lands of south Alabama and Florida, and the value of the lumber annually taken to market by the river is estimated at nearly $2,000,000.

In order that the business may be carried on safely and profitably the river should be kept free from snags and like obstructions by an efficient snag boat; and a channel 100 feet wide and 8.5 feet deep should be dredged through the bar at the mouth of the river, in order that the large tugs employed in towing the rafts to Pensacola may cross the bar and enter the river for the purpose of reaching the rafts. The rafts are now floated across the bar and fastened to timber stands in the open bay, where they are exposed to sudden storms, and a large annual loss in money and lumber is thus occasioned.

July 1, 1894, balance unexpended	$285.08
Amount appropriated by act of August 17, 1894	6,000.00
	6,285.08
June 30, 1895, amount expended during fiscal year	1,693.38
July 1, 1895, balance unexpended	4,591.70
July 1, 1895, outstanding liabilities	480.84
July 1, 1895, balance available	4,110.86
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	4,000.00

(See Appendix O 7.)

8. Alabama River, Alabama.—The river was so full of sunken logs and snags before improvements were begun, in 1878, that many steamboats were destroyed and navigation was both difficult and dangerous, on account of the many bars, shoals, and reefs, having low-water depths of only 3.5 to 3.5 feet. That portion of the river below the cut-off, 20 miles in length, was absolutely inaccessible during low water, and all landings situated thereon had been deprived of steamboat service. At low-water stages boats could only run by daylight, and long detentions at the shoals and bars were frequent. The normal width of the upper river is from 500 to 600 feet and of the lower river from 700 to 800 feet. In the portions of the river having these widths the low-water depths

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vary from 8 to 15 feet, but where the river has been widened by the erosion of its banks, bars, shoals, and reefs are found.

The original plan of improvement, adopted pursuant to an examination and partial survey of this river made under the act of Congress approved March 3, 1875, provided for obtaining a 4-foot low-water channel from the mouth of the river to Wetumpka, Ala. In 1892 the present plan of improvement was adopted, which provides for obtaining a low-water channel 6 feet deep from Wetumpka, Ala., to the junction with the Tombigbee River, 44 miles above Mobile, Ala., an estimated distance of 323 miles, by the removal of logs and snags from the channel and overhanging trees from the banks; by the removal of rock reefs and gravel bars by blasting and dredging, and deepening sand bars by works of contraction and shore protection, at an estimated cost of $386,251, exclusive of the cost of maintenance and snagging, estimated at $10,000 per annum.

The expenditure of $270,372.79, to June 30, 1895, has resulted in clearing the river of dangerous snags, logs, and overhanging trees; in maintaining an efficient stern-wheel snag boat; in procuring an efficient plant for the construction of contraction and shore-protection works; in improving many of the worst bars, and in protecting the shores at many points.

During the fiscal year ending June 30, 1895, the various operations of snagging, contracting the channel, and protecting the banks were continued with satisfactory results. The low-water depth on 11 bars is now 5 to 8 feet. The increased depths vary from 2 to 5.5 feet. The river is now navigable from Montgomery to Mobile at low water for boats not exceeding 4.5 feet draft.

When the appropriation of $70,000 by act of July 13, 1892, became available the only plant on this river consisted of the efficient stern-wheel snag boat *Wm. J. Twining*. A plant for two large working parties, one on the upper and one on the lower river, has now been procured, each plant consisting of one stern-wheel towboat, one quarter boat, one pile-driver barge, one small decked flatboat for carrying piles, two stone barges, and one brush barge. The towboat for one party is the snag boat *Twining*. The contraction works, built in 1878 and 1883 and in 1892, 1893, 1894, and 1895, have given so satisfactory results that no special difficulty is anticipated in securing low-water depths of 6 feet on the bars now having less depths, provided sufficiently large appropriations are made to carry on the work with an efficient plant and a large working force during the low-water season.

July 1, 1894, balance unexpended	$4,092.76
Amount appropriated by act of August 17, 1894	50,000.00
	54,092.76
June 30, 1895, amount expended during fiscal year	19,316.19
July 1, 1895, balance unexpended	34,776.60
July 1, 1895, outstanding liabilities	868.94
July 1, 1895, balance available	33,907.66
Amount (estimated) required for completion of existing project	286,251.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	50,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix O 8.)

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9. Coosa River, Georgia and Alabama.—With head waters in the mountains of northwestern Georgia, the Coosawattee, Oostenaula, Coosa, Alabama, and Mobile rivers form, in fact, one great river, which, when the improvement of the Coosa River is completed, will furnish a continuous route of water transportation 776 miles in length through the mineral fields of north Alabama, the agricultural belt of middle Alabama, and the timber region of south Alabama to tide water at Mobile Bay.

A distance of 293 miles of this waterway above Lock No. 4 (3 miles above the Georgia Pacific Railroad bridge) and a distance of 367 miles between Wetumpka and Mobile, are now navigable.

Between Lock No. 4 and Wetumpka, a distance of 116 miles, the Coosa River has a fall of 323 feet, and is obstructed by a series of rock shoals and reefs, separated by stretches of good navigable water, varying in length from one-half to 8 miles. The low-water discharge of the Coosa River at Wetumpka is 5,800 cubic feet per second.

The abundance of water, the stability of the banks and bottom of the river, and the rock foundations for locks and dams presented in nearly all cases, make the lower portion of the river peculiarly susceptible to permanent improvement by a system of slack-water navigation.

Pursuant to the various examinations and surveys made between 1870 and 1889 a plan of improvement has been adopted which contemplates the removal of the lesser rock shoals, sand and gravel bars by excavation and by works of contraction and the construction of locks and dams to overcome the more serious obstructions.

By the various acts making appropriations for its improvement the Coosa River has been divided into two sections by the East Tennessee, Virginia and Georgia Railroad bridge.

In the upper section, between Rome and the bridge (236 miles long), 8 locks with their accessory dams will be required, of which 3 have been completed and opened to navigation and the fourth is now under construction.

In the lower section, between Wetumpka and the bridge (68 miles long), 23 locks with their accessory dams will be required, of which Lock No. 31, at Wetumpka, is now under construction. The first appropriation for this section of the river was made by the act of September 19, 1890.

(*a*) *Between Rome, Ga., and the East Tennessee, Virginia and Georgia Railroad bridge.*—Before improvement the river was much obstructed by rock shoals and sand and gravel bars between Rome, Ga., and Greensport, Ala., a distance of 162 miles, and below Greensport it was not navigable at all on account of the many shoals and rapids formed by ledges of rock crossing the river bottom at points where the width of the river was greater than the normal.

The expenditure up to June 30, 1895, of $871,989.43 had resulted in securing a fairly navigable channel from Rome to Greensport by blasting out the rock shoals and by the construction of wing dams to scour out the sand bars.

Below Greensport, at distances, respectively, of 0.68, 3.86, and 5.24 miles, 3 masonry locks, each having an available width of 40 feet and length of 175 feet, with their accessory dams, had been completed and opened to navigation. In consequence of the improvement steamboats made regular trips between Rome and Gadsden, and, when business demanded it, extended their trips to a landing 1 mile below Lock No. 3.

At the site of Lock No. 4, 21 miles below Lock No. 3, the dam and its abutment have been finished as originally designed. An increase of

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height of 3 feet, authorized for the dam during the past year, remains to be added. The cofferdam for the lock as placed in the beginning is finished. The change in the location of the lock requires an extension of the cofferdam. This is yet to be made.

A concrete floor 8 feet thick was authorized for this lock last year. One-half the excavation for this floor was finished when the work closed for the year. The transverse wall at the head of the lock, to prevent leakage under the floor, was put in. A contract for cement was made. A plant for crushing stone and one for mixing concrete were put up.

The river for a distance of 20 miles below Rome had become much obstructed by sand and gravel bars. It was restored to its original condition. The work of cutting a channel through Alligator Reef, Woods Reef, McCoy Island Shoal, and Box Shoal was continued until stopped by high water.

In the improved portions during about nine months of the year, there is 5 feet or more of water in the shoal places, and for the remaining three months there is ordinarily 3 feet. The river is never closed by ice.

It was hoped last year that Lock No. 4 would be completed and opened to navigation during the fiscal year just passed, but the small appropriation made for this part of the Coosa River did not permit it.

July 1, 1894, balance unexpended		$3,888.91
Amount appropriated by act of August 17, 1894		110,000.00
		113,888.91
June 30, 1895, amount expended during fiscal year		72,178.34
July 1, 1895, balance unexpended		41,710.57
July 1, 1895, outstanding liabilities	$8,745.36	
July 1, 1895, amount covered by uncompleted contracts	23,120.00	
		31,865.36
July 1, 1895, balance available		9,845.21

Amount (estimated) required for completion of existing project	850,133.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	187,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(*b*) *Between Wetumpka, Ala., and the East Tennessee, Virginia and Georgia Railroad bridge.*—The first appropriation for the improvement of this section of the river was made by the act of September 19, 1890.

To June 30, 1895, the sum of $258,500.01 was expended in securing the necessary outfit and in making detailed surveys for the precise location of the locks near Wetumpka and in making a series of velocity and discharge observations, extending from high to low water; in filling up and grading the yard at the site of Lock No. 31 and building thereon workshops, etc; in the purchase of machinery and plant for the construction of the cofferdam and Lock No. 31; in excavating rock from the channel of the river above Wetumpka Bridge, and in building a breakwater to divert the current from the lock site; in building the cofferdam; in laying a narrow-gauge track from the lock to the head of the rapids and to the yards of the Louisville and Nashville Railroad; in setting up pumping, stone-crushing, and concrete-mixing plants; in building storehouses and sheds for materials; in excavating the lock pit, and in beginning the construction of the lock, which has been raised at all points to a height of 10 feet 9 inches above the level of the lower miter sill. The total amount of concrete placed was 8,710 cubic yards, at a cost for labor and materials alone of $4.57\frac{3}{10}$ per cubic yard.

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July 1, 1894, balance unexpended		$74,762.56
Amount appropriated by act of August 17, 1894		110,000.00
		184,762.56
June 30, 1895, amount expended during fiscal year		83,255.32
July 1, 1895, balance unexpended		101,507.24
July 1, 1895, outstanding liabilities	$5,978.46	
July 1, 1895, amount covered by uncompleted contracts	27,200.00	
		33,178.46
July 1, 1895, balance available		68,328.78

Amount (estimated) required for completion of existing project	4,733,074.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	312,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix O 9.)

10. Operating and care of canals and other works of navigation on Coosa River, Georgia and Alabama.—The expenses of operating and care of Locks Nos. 1, 2, and 3 and the canal between Locks Nos. 2 and 3 during the fiscal year ending June 30, 1895, amounting to $4,499.19, have been paid in the way indicated by section 4, act of July 5, 1884. (See Appendix O 10.)

EXAMINATION MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examination of *Carrabelle Bar and Harbor, Florida*, required by the act of August 17, 1894, was made by the local engineer, Maj. F. A. Mahan, Corps of Engineers, and his report thereon, dated February 7, 1895, was submitted through the division engineer, Col. H. M. Robert, Corps of Engineers.

In the opinion of Major Mahan, concurred in by the division engineer and by this office, the locality is worthy of improvement at least to the extent of making a 10-foot channel from the mouth of Carrabelle River to the channel in the bay. No further survey will be necessary, as an estimate of sufficient accuracy can be made from existing charts. The report was transmitted to Congress and printed in House Ex. Doc. No. 328, Fifty-third Congress, third session. (See also Appendix O 11.)

IMPROVEMENT OF RIVERS AND HARBORS IN WESTERN ALABAMA AND EASTERN MISSISSIPPI, AND OF BOGUE CHITTO, LOUISIANA.

This district was in the charge of Maj. A. N. Damrell, Corps of Engineers, with Lieut. Eben E. Winslow, Corps of Engineers, under his immediate orders. Division Engineers, Col. C. B. Comstock, Corps of Engineers, to February 3, 1895, and Col. H. M. Robert, Corps of Engineers since February 5, 1895.

1. Mobile Harbor, Alabama.—The channel had originally a minimum depth of 5½ feet through Choctaw Pass and 8 feet on Dog River Bar. This was deepened to 10 feet through both by dredging under appropriations from 1826 to 1852 of $228,830.68. In 1860 the channel in Choctaw Pass had shoaled to 7½ feet. From 1870 to 1878 the channel was deepened by dredging to 13 feet under appropriations amounting to $401,000. Length of cut, 8 miles.

From 1881 to 1888 the channel was deepened by dredging to 17 feet under appropriations amounting to $740,000, but this project was not completed when the last project was adopted. The length of cut was 25.91 miles.

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The present project for the improvement of this harbor was adopted in August, 1888, the object being to afford a channel of entrance from the Gulf of Mexico to the city of Mobile of 280 feet width on top of cut with a central depth of 23 feet at mean low water, by dredging, at an estimated cost of $1,980,000. Act of September 19, 1890, extended the work up Mobile River to the mouth of Chickasabogue Creek and increased the estimated cost to $2,043,800. The entire length of channel under present project is 33.09 miles and the entire length of continuous cut is 32.27 miles. The amount expended on the present project up to the close of the fiscal year ending June 30, 1894, was $1,142,564.56, and resulted as follows:

The average central depth of the dredged channel on June 30, 1894, was 25.2 feet and the minimum depth on that date was 19.6 feet. The amount expended during the fiscal year ending June 30, 1895, was $544,414.28, and on that date the average central depth of the entire channel was 26.5 feet and the minimum central depth in the river was 23.5 feet and in the bay was 23.8 feet, with an average increase of bottom width of 90 feet.

July 1, 1894, balance unexpended		$169,235.44
Amount appropriated by sundry civil act approved August 18, 1894		390,000.00
Amount appropriated by sundry civil act approved March 2, 1895		291,300.00
		851,235.44
June 30, 1895, amount expended during fiscal year		544,414.28
July 1, 1895, balance unexpended		306,821.16
July 1, 1895, outstanding liabilities	$157,698.15	
July 1, 1895, amount covered by uncompleted contracts	126,000.00	
		283,698.15
July 1, 1895, balance available		23,123.01
Amount (estimated) required for preservation of improvement		300,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		150,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix P 1.)

2. Black Warrior River, Alabama, from Tuscaloosa to Daniels Creek.—The present channel is only navigable during very high water, and even then very dangerous.

The present project for the improvement of the river was approved in 1887, the object being to afford a waterway for the transportation of coal, iron ore, iron, etc., in barges, from the Warrior coal fields to the Gulf of Mexico, by the construction of five locks and dams at an estimated cost of $741,070.

The amount expended to June 30, 1894, was $480,972.11, resulting as follows:

Completion of lock tender's house.

Completion of masonry for Locks 1, 2, and 3 and their abutments.

Dam and guide crib for Lock No. 3 partly built.

The amount expended during the fiscal year ending June 30, 1895, was $61,885.28, resulting as follows:

Three dams and guide cribs have been built, and the hanging of gates and valves for Lock No. 1 completed. Those for Lock No. 2 and Lock No. 3 have been fitted and partly hung.

Needle dams with iron trestles have been prepared for three locks to take the place of the wooden wickets at first used, which did not prove satisfactory.

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July 1, 1894, balance unexpended	$75,277.80
Amount appropriated by act of August 17, 1894	37,500.90
	112,777.89
June 30, 1895, amount expended during fiscal year	61,885.28
July 1, 1895, balance unexpended	50,892.61

Amount (estimated) required for completion of existing project	200,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix P 2.)

3. Warrior and Tombigbee rivers, Alabama and Mississippi.—(*a*) *Warrior River, Alabama.*—The channel of this river was originally obstructed to such an extent by logs, snags, overhanging trees, and numerous bars that navigation at low water was impossible, and at high water extremely hazardous.

The present project for the improvement of this river was adopted in 1890, the object being to obtain a channel 6 feet deep at ordinary low water from Tuscaloosa to its mouth, by removal of logs, snags, and overhanging trees, the improvement of bars, bank revetment, and the construction of locks and dams, at an estimated cost of $557,000.

The amount expended up to the close of the fiscal year ending June 30, 1894, was $99,260.74, in preparation of plant and the removal of snags, logs, slip-ins, and overhanging trees.

The amount expended during the fiscal year ending June 30, 1895, was $23,103.98, in the removal of snags, logs, slip-ins, rock, and gravel from bars, masonry from Forrest Pier, and the construction of dams, dikes, and jetties, and revetment of caving banks.

July 1, 1894, balance unexpended	$34,707.24
Amount appropriated by act of August 17, 1894	40,000.00
	74,707.24
June 30, 1895, amount expended during fiscal year	23,103.98
July 1, 1895, balance unexpended	51,603.26

Amount (estimated) required for completion of existing project	417,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	96,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(*b*) *Tombigbee River up to Demopolis, Ala.*—The channel originally had a minimum depth of 2 feet. The present project for the improvement of this section of the river was adopted in 1890, the object being to secure a channel of 6 feet depth at low water by the removal of logs, snags, trees, and bank revetment, and the construction of locks and dams, at an estimated cost of $508,808. The entire length of this section to be improved is 191 miles.

The amount expended prior to June 30, 1894, was $93,514.08, and resulted in the removal of logs, snags, and trees from this entire section of the river, in the repair of jetties at Osage and Barneys shoals, the partial removal by blasting of rock shoals at Woods Bluff, McGrews, and Pearsons, and the removal by dredging of bars at Rainwater and Barneys.

The amount expended during the fiscal year ending June 30, 1895, was $26,006.56, and was expended in removing the annual accumulation of snags and obstructions, dredging bars at Peaveys and Harwells, repairing jetties at Peaveys, making borings at McGrews.

Amount expended to June 30, 1895, $119,580.64, of which amount $23,147.16 was for preservation of improvement already obtained.

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July 1, 1894, balance unexpended		$86,485.92
Amount appropriated by act of August 17, 1894		75,000.00
		161,485.92
June 30, 1895, amount expended during fiscal year		26,066.53
July 1, 1895, balance unexpended		135,419.39
Amount (estimated) required for completion of existing project		253,808.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		97,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(*c*) *Tombigbee River, from Demopolis, Ala., to Columbus, Miss.*—The present channel has a minimum depth of 1 foot.

The present project for the improvement of this section of the river, 156 miles in length, was adopted in 1890, the object being to obtain a channel of 6 feet depth at ordinary low water by removal of snags, logs, etc., bank revetment, and construction of locks and dams, at an estimated cost of $779,400.

The amount expended up to June 30, 1894, was $34,193.47, and resulted in the removal of logs, snags, etc., for nearly the whole distance.

The amount expended during the fiscal year ending June 30, 1895, was $6,662.91, and resulted in clearing the remaining distance and the removal of obstructions that had accumulated since the work of the previous year over the greater portion of this section.

July 1, 1894, balance unexpended		$15,806.53
Amount appropriated by act of August 17, 1894		50,000.00
		65,806.53
June 30, 1895, amount expended during fiscal year		6,662.91
July 1, 1895, balance unexpended		59,143.62
Amount (estimated) required for completion of existing project		679,400.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		96,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(*d*) *Tombigbee River from Fulton to Columbus.*—The channel before improvement was not navigable at all except during high water, and navigation was practically suspended when the river reached 12 feet above low water.

The project for the improvement of this section of the river, from Fulton to Columbus, 144 miles, was adopted in 1873, the object being to give a good high-water channel throughout by the removal of snags, logs, and overhanging trees, at an estimated cost of $35,000, and was completed in 1882 at a cost of $27,293.65.

The amount expended up to June 30, 1894, was $44,012.24, and resulted in the completion of the improvement and partial preservation of same.

The amount expended during the fiscal year ending June 30, 1895, was $50.48 in preservation of the improvement.

July 1, 1894, balance unexpended		$121.01
Amount appropriated by act of August 17, 1894		4,000.00
		4,121.01
June 30, 1895, amount expended during fiscal year		50.48
July 1, 1895, balance unexpended		4,070.53
Amount (estimated) required for preservation of improvement		20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

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(e) *Tombigbee River from Walkers Bridge to Fulton, Miss.*—The channel was originally only navigable for small rafts during high water and very troublesome then.

The present project for the improvement of this section of the river was adopted in 1888, the object being to obtain a good channel for navigation during high water by the removal of logs, snags, stumps, and overhanging trees, at an estimated cost of $11,000.

The amount expended to June 30, 1894, was $10,982.07, of which $3,300.96 was in preservation of improvement, and resulted in the completion of the project and the removal of the annual accumulation of snags, logs, and trees.

July 1, 1894, balance unexpended	$17.93
July 1, 1895, balance unexpended	17.93
Amount (estimated) required for preservation of improvement	2,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	1,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix P 3.)

4. *Noxubee River, Mississippi.*—The original condition of the river was such that during all seasons of the year and at all stages of water navigation except by small flatboats was practically impossible. The present project for the improvement of this river was adopted in 1880, the object being to afford a channel for small river steamers from its mouth up to Macon, Miss., of navigable width and depth when the water is above ordinary low-water stage.

The amount expended up to the close of the fiscal year ending June 30, 1894, was $54,062.63, and resulted in the completion of the project. Of this amount $4,350.09 was expended in maintenance.

The amount expended during the fiscal year ending June 30, 1895, was $4,034.18, and was used in removing the obstructions that have accumulated since the completion of the project.

July 1, 1894, balance unexpended	$1,937.37
Amount appropriated by act of August 17, 1894	3,000.00
	4,937.37
June 30, 1895, amount expended during fiscal year	4,034.18
July 1, 1895, balance unexpended	903.19
Amount (estimated) required for preservation of improvement	9,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	3,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix P 4.)

5. *Pascagoula River, Mississippi.*—The channel over the bar before the improvement commenced had a least depth of 3 feet. This was increased to 7½ feet with a width of 180 feet by dredging, from 1878 to 1880, at a cost of about $42,500. From the light-house near the mouth of the river to its head there was a navigable channel obtained by the removal of snags and overhanging trees, from 1881 to 1884, inclusive, at a cost of about $15,000.

The present project for the improvement of this river was adopted in 1886, the object being to afford a channel of navigable width and minimum depth of 12 feet at mean low water from Moss Point down to the anchorage in the sound, and to maintain the river above Moss Point in its improved condition, at an estimated cost of $78,100 for the channel from Moss Point down and $2,500 annually for preservation of improvement above Moss Point.

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The amount expended up to June 30, 1894, was $91,966.40, of which $5,281.79 was in preservation of the improvement.

The amount expended during the fiscal year ending June 30, 1895, was $2,078.94, and resulted in preservation of the improvement as high up as Cedar Creek.

July 1, 1894, balance unexpended	$33.60
Amount appropriated by act of August 17, 1894	13,000.00
	13,033.60
June 30, 1895, amount expended during fiscal year	2,078.94
July 1, 1895, balance unexpended	10,954.66
Amount (estimated) required for completion of existing project	36,000.00
Amount (estimated) required for preservation of improvement above Moss Point	25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	3,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix P 5.)

6. Chickasahay River, Mississippi.—At the time of the adoption of the present project the channel was only navigable for small rafts during high water, and was difficult and troublesome for them. The minimum width of the channel is 50 feet and the minimum depth 0.5 foot at extreme low water. The project for the improvement of this river was adopted in 1890, the object being to obtain a good high-water channel from the mouth up to the railroad bridge at Shubuta by the removal of snags, logs, overhanging trees, etc., at an estimated cost of $30,000.

The amount expended to June 30, 1894, was $9,959.71, and resulted in the complete improvement of the river from the mouth up to Crawfords Landing, a distance of 22¾ miles, and the partial improvement from there up to Waynesboro.

The amount expended during the fiscal year ending June 30, 1895, was $328.83 in preservation of the improvement.

July 1, 1894, balance unexpended	$40.29
Amount appropriated by act of August 17, 1894	5,000.00
	5,040.29
June 30, 1895, amount expended during fiscal year	328.83
July 1, 1895, balance unexpended	4,711.46
Amount (estimated) required for completion of existing project	15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	2,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix P 6.)

7. Leaf River, Mississippi.—At the time of the adoption of the present project the river was not navigable on account of snags, logs, and overhanging trees.

The minimum width of the river channel is 100 feet and the minimum depth 2.5 feet.

The project for the improvement of this river was adopted in 1890, the object being to obtain a high-water channel from the mouth to the mouth of Bowie Creek, a distance of 75 miles, by the removal of snags, logs, and overhanging trees, at an estimated cost of $25,000.

The amount expended to June 30, 1894, was $9,209.39, and resulted in giving a fully improved channel for 60 miles up. Of this amount $2,617.27 was expended in preservation of the improvement.

The amount expended during the fiscal year ending June 30, 1895, was $199.95 in preservation of improvement.

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July 1, 1894, balance unexpended	$790.61
Amount appropriated by act of August 17, 1894	2,500.00
	3,290.61
June 30, 1895, amount expended during fiscal year	199.95
July 1, 1895, balance unexpended	3,090.66
Amount (estimated) required for completion of existing project	12,500.00
Amount (estimated) required for preservation of improvement	3,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	2,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix P 7.)

8. Harbor at Biloxi Bay, Mississippi.—The original condition of the channel was such as to allow vessels of 4 feet draft to enter the harbor at low water.

The amount expended to June 30, 1895, was $44,288.15, and resulted in giving a channel 160 feet wide and 9 feet deep.

The project is completed.

About $8,000 every four or five years will be ample for preservation of the improvement.

July 1, 1894, balance unexpended	$711.85
July 1, 1895, balance unexpended	711.85

(See Appendix P 8.)

9. Pearl River, below Jackson, Miss.—The original condition of this portion of the river was such as to allow navigation only during high water, and then it was difficult and dangerous.

The minimum width of the stream was 190 feet, except through Holmes Bayou, which was only 65 feet wide. The minimum depth of the channel at low water was 1½ feet.

The original project for the improvement was adopted in 1880, the object being to obtain a 5-foot channel at low water at an estimated cost of $95,940. This depth was found impracticable, and the project was therefore modified in 1885 so as to reduce the depth to 2 feet and increase the estimate $50,000.

The amount expended on the work up to June 30, 1894, was $124,527.44, and resulted in allowing light-draft boats to navigate from the mouth to Wheats Field, 106 miles, all the year, completing that portion according to project.

The amount expended during the fiscal year ending June 30, 1895, was $11,619.87, and resulted in the improvement of the river up to Brandons Ferry, 39 miles, according to project.

One hundred and forty-five miles of the river have been fully improved according to project, and 1.0 miles, from Brandons Ferry to Jackson, have been only partially improved.

The total amount expended up to June 30, 1895, is $136,147.31, of which $33,159.98 was in preservation of the improvement.

July 1, 1894, balance unexpended	$18,597.56
Amount appropriated by act of August 17, 1894	5,000.00
	23,597.56
June 30, 1895, amount expended during fiscal year	11,619.87
July 1, 1895, balance unexpended	11,977.69
Amount (estimated) required for completion of existing project	*50,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix P 9.)

* This amount is increased to include and replace $35,000 which has been expended in preservation of the improvement.

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10. Pearl River, between Carthage and Jackson, Miss.—The original condition of this part of the river was such as to make navigation almost impossible except at high water.

The minimum width of the river was 100 feet; the minimum width of the channel was 40 feet.

The original project was to afford a clear channel of navigable width 5 feet deep at low water from Jackson to Carthage, 105 miles, at an estimated cost of $21,000.

In 1886 the project was changed so as to reduce the depth to be obtained to 2 feet, and the estimate of cost was increased $29,000.

The amount expended on this work up to the close of the fiscal year ending June 30, 1894, was $29,741.92, and resulted in the completion of the project and preservation of the improvement.

The condition of the improvement on June 30, 1894, was such as to allow light-draft boats to navigate safely on a 3-foot stage above low water from Jackson to Carthage.

The amount expended during the fiscal year ending June 30, 1895, was $3,203.90, in preservation of the improvement.

July 1, 1894, balance unexpended	$1,508.08
Amount appropriated by act of August 17, 1894	2,400.00
	3,908.08
June 30, 1895, amount expended during fiscal year	3,203.90
July 1, 1895, balance unexpended	704.18

Amount (estimated) required for preservation of improvement	7,200.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	1,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix P 10.)

11. Pearl River, between Edinburg and Carthage, Miss.—The original condition of this portion of the river was such that navigation at low water was impossible, and even during high water it was difficult and dangerous.

The minimum width of the channel was 20 feet; the minimum depth at low water was 8 inches.

The project for the improvement adopted in 1884 was to afford a high-water channel from Edinburg to Carthage, a distance of 24¾ miles for six or eight months of the year, at an estimated cost of $13,464.

The amount expended on this work up to June 30, 1894, was $14,727.59, and resulted in completion of the project.

The condition of this part of the river on June 30, 1894, was such as to allow light-draft boats to navigate with comparative safety from Edinburg to Carthage on a 4-foot rise above ordinary low water.

Total amount expended up to June 30, 1895, was $14,741.35, of which $4,078.86 was in preservation of the improvement.

July 1, 1894, balance unexpended	$508.65
Amount appropriated by act of August 17, 1894	500.00
July 1, 1895, balance unexpended	1,008.65

Amount (estimated) required for preservation of improvement	1,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix P 11.)

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12. Bogue Chitto, Louisiana.—The channel at present is not navigable at ordinary low water from a point 34¾ miles above the mouth, which has been improved according to project, it being obstructed by snags, logs, fish traps, overhanging trees, etc.

The minimum width of the stream is 120 feet and that of the channel 80 feet; the minimum depth is 3 feet.

The project for the improvement of this river was adopted in 1890, the object being to obtain a 3-foot channel during the greater part of the year by the removal of logs, snags, fish traps, etc., from the mouth up to Alfords Bridge, at an estimated cost of $55,000.

The amount expended June 30, 1894, was $6,624.20, and resulted in the improvement of 18 miles of river from the mouth up according to the project.

The amount expended during the fiscal year ending June 30, 1895, was $3,629.21, and resulted in opening the mouth for 3-feet draft at low water and the improvement of 16¾ miles more of river according to project.

July 1, 1894, balance unexpended	$2,375.80
Amount appropriated by act of August 17, 1894	5,000.00
	7,375.80
June 30, 1895, amount expended during fiscal year	3,629.21
July 1, 1895, balance unexpended	3,746.59
Amount (estimated) required for completion of existing project	40,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix P 12.)

13. Removing sunken vessels or craft obstructing or endangering navigation.—April 22, 1893, an allotment was made from the permanent indefinite appropriation provided by section 4 of the river and harbor act of June 14, 1880, for the removal of the wreck of a sunken dry dock in Mobile River, Alabama.

The amount expended during the fiscal year ending June 30, 1894, was $615.57 for inspection of contract work.

Contract was made with W. H. Brown for this work at $2,500.

The contractor has abandoned the work without completing, having removed arches, machinery, top, and portion of sides and ends, leaving ballast, entire bottom, part of sides and ends to be removed.

Under date of June 30, 1894, authority was granted to annul existing contract and remove the remainder of the dry dock by hired labor.

Under this authority work was commenced on July 11, 1894, and continued until February 7, 1895.

The condition of the sunken dry dock on June 30, 1895, is as follows: The greater part of the bottom, with about 60 tons of rock ballast, still remains covered by 7 feet of mud.

Total amount expended on the work up to June 30, 1895, $2,997.19.

(See Appendix P 13.)

EXAMINATIONS AND SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations and survey of the following localities, required by the act of August 17, 1894, were made by the local engineer, Maj. A. N. Damrell, Corps of Engineers, and reports thereon submitted through the division engineer:

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1. Preliminary examination of the bar recently formed in Horn Island Pass, Mississippi.—Major Damrell submitted report of examination December 4, 1894. He is of opinion that the locality is worthy of improvement by the General Government, and his views are concurred in by the division engineer, Colonel Comstock, and by this office. It is estimated that the surveys necessary for preparation of plan of improvement, with estimates, will cost $900. The report was transmitted to Congress and printed in House Ex. Doc. No. 104, Fifty-third Congress, third session. (See also Appendix P 14.)

2. Preliminary examination of Noxubee River, Mississippi, from Macon to mouth of Hashuqua Creek.—Major Damrell submitted report of examination December 4, 1894. In his opinion, concurred in by the division engineer, Colonel Comstock, and by this office, this portion of the river is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 103, Fifty-third Congress, third session. (See also Appendix P 15.)

3. Survey for channel between Mobile Bay and Mississippi Sound.—Major Damrell submitted report of survey December 12, 1894. He states that a survey, provided for by the river and harbor act of August 2, 1882, for the same purpose, under the title, "Shoal between Dauphin Island and Cedar Point, Alabama," had already been made and report, with estimates and maps, submitted February 28, 1884 (printed in Annual Report Chief of Engineers, 1884, pp. 1229–1234), and it was therefore not deemed advisable to incur the expense of another.

He further states that the best point for the proposed channel would be "Grant's Pass" or "Pass Aux Herons," either of which is available, the choice depending upon the price that would have to be paid for Grant's Pass, which is private property, and submits the following estimates of cost of a sufficient channel having a minimum top width of 150 feet and a minimum central depth of 9 feet at mean low water for the proper accommodation of commerce:

By Pass Aux Herons	$92,000
By Grant's Pass (not including cost of purchase of the pass)	85,000

The report was transmitted to Congress and printed in House Ex. Doc. No. 134, Fifty-third Congress, third session. (See also Appendix P 16.)

INSPECTION OF THE IMPROVEMENT OF THE SOUTH PASS OF THE MISSISSIPPI RIVER.

The act of Congress of March 3, 1875, amended by acts of June 19, 1878, and March 3, 1879, made provision for the construction, by James B. Eads, or his representatives, of jetties and other works in the South Pass of the Mississippi River, to secure and maintain a channel through the Pass 26 feet deep, and through the jetties 26 feet deep and 200 feet wide at bottom, with a central depth of 30 feet; an annual payment of $100,000 was provided for the maintenance of such a channel for twenty years after first obtaining it by the works built. The required channels were secured in July, 1879.

The object of the examinations and surveys of the South Pass, the expenses of which are now provided for by the permanent indefinite appropriation made by act of August 11, 1888, is to determine if the channel is maintained as required by law, and to enable the inspecting officer to issue the certificates required for the quarterly payments. The officer in charge of these surveys is Maj. James B. Quinn, Corps of Engineers, whose annual report thereon and on work done during the year is submitted as Appendix Q.

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July 1, 1894, balance unexpended	$1,152.97
Amount allotted for fiscal year 1894–95 under act of August 11, 1888	10,000.00
	11,152.97
June 30, 1895, amount expended during fiscal year	8,933.33
July 1, 1895, balance unexpended	2,219.64
July 1, 1895, outstanding liabilities	1,060.05
July 1, 1895, balance available	1,159.59
Amount allotted for fiscal year 1895–96 under act of August 11, 1888	10,000.00
Amount available for fiscal year ending June 30, 1896	11,159.59

(See Appendix Q.)

IMPROVEMENT OF RIVERS AND HARBORS IN SOUTHERN LOUISIANA AND EASTERN TEXAS.

This district was in the charge of Maj. James B. Quinn, Corps of Engineers; Division Engineers, Col. C. B. Comstock, Corps of Engineers, to February 3, 1895, and Col. H. M. Robert, Corps of Engineers, since February 5, 1895.

1. Chefuncte (Tchefuncte) River and Bogue Falia, Louisiana.—Previous to improvement these streams were obstructed by snags, logs, and overhanging trees. The bar at the mouth of the river had a depth of water of about 4½ feet at the lowest stage.

The project for the improvement of the river was adopted in 1880 and contemplated the removal of obstructions in the channel and the dredging of the bar at its mouth, and was modified in 1884 so as to provide for the building of a breakwater across the bar.

With the first two appropriations of $1,500 each, made in 1881 and 1882, the obstructions were removed below Covington, and part of the unexpended balance was used for constructing 820 feet of the breakwater, but the bar at the mouth was not dredged, as it would be likely to re-form.

To prevent this or retard its re-formation the officer in charge in 1884 recommended building a breakwater extending 2,500 feet into the lake and then dredging a channel through the bar.

The original estimated cost of the improvement was $5,460, but this did not provide for building the breakwater.

Under the appropriation of $2,500 made in 1886 channels 5 feet in depth and 30 to 60 feet wide were cut through the bars on the Bogue Falia between Old Landing and Covington, giving better navigation for schooners to and from Covington.

Under the appropriation of $1,000 made in 1890, work was commenced in October, 1891, with the Government snagging plant and hired labor, and the river was cleared of obstructions from Madisonville to Old Landing, and from the latter place to Covington, on the Bogue Falia, as far as the available funds would permit. Work was discontinued November 30, 1891, and the plant laid up at Madisonville.

With the appropriation of $1,000 made in 1892, the snagging plant used on the improvement of these streams was extensively repaired, but no other work done.

The total amount expended on these streams to June 30, 1894, was $6,965.39. The river was then navigable for steamers drawing 5 feet to Old Landing, about 12 miles above its mouth, and then for the lighter draft schooners to Covington, about 2 miles farther up on the Bogue Falia.

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Under the appropriation of $1,000 for maintenance, made August 17, 1894, channels 6 feet deep and about 60 feet wide were dredged through the bars below Covington in February, 1895, under contract, rendering navigation available for steamers drawing 5 feet from the mouth of the river clear to Covington, on the Bogue Falia, a distance of about 14 miles.

The amount expended during the year just closed was $1,340.92.

July 1, 1894, balance unexpended	$534.61
Amount appropriated by act of August 17, 1894	1,000.00
	1,534.61
June 30, 1895, amount expended during fiscal year	1,340.92
July 1, 1895, balance unexpended	193.69
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	1,000.00

(See Appendix R 1.)

2. Tickfaw River and its tributaries, Louisiana.—When the project for improvement was adopted the Tickfaw River and its navigable branches were obstructed by snags, sunken logs, and trees.

Congress authorized an examination of this river in 1879. A project was submitted in 1881 to clean out the river and its principal tributaries, the Natalbany, Blood, and Ponchatoula rivers, by removing the obstructions, at an estimated cost of $10,230.

To June 30, 1891, the appropriations made by Congress in 1881, 1882, 1886, and 1888, aggregating $7,000, had been expended. Twenty miles of the Tickfaw and the Natalbany to Springfield, the head of navigation, had been improved. Work was also done at Ponchatoula as far as it was thought advisable, and the Blood River had been cleaned out as far as navigable.

Under the appropriation of $1,000, made September 19, 1890, work of removing the obstructions that had re-formed since 1889 was commenced September 14, 1891, with hired labor and the use of the Government snagging plant, which had but recently finished work on the Amite River. Operations were discontinued in October of that year.

Snags, overhanging trees, and logs were removed from the Tickfaw, Natalbany, and Blood rivers, the latter being cleared to the head of navigation. The extent of channels improved on the three rivers was about 39 miles.

Under the appropriation of July 13, 1892, work was commenced at the mouth of the river on December 20, 1892. The result of operations during that fiscal year was the improvement of about 30 miles of channel by removing obstructions.

To the close of the year ending June 30, 1894, there had been expended on these streams the sum of $8,826.30. The work done has resulted in a very material increase in the commerce of the river. Most of the shipments are made direct to New Orleans.

The appropriation of $1,000 made August 17, 1894, was expended in removing obstructions. The snagging plant was again repaired and work commenced in December of that year and completed February 8, 1895, resulting in the removal of the most serious obstructions which had re-formed in the channel. The cost of the improvement during the year just closed amounted to $1,036.51.

The streams are now in fair condition, but as obstructions continue to form the improvement is not permanent.

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It is estimated that $1,000 will be required annually to keep the channels in good condition.

July 1, 1894, balance unexpended	$173.70
Amount appropriated by act of August 17, 1894	1,000.00
	1,173.70
June 30, 1895, amount expended during fiscal year	1,036.51
July 1, 1895, balance unexpended	137.19
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	1,000.00

(See Appendix R 2.)

3. Amite River and Bayou Manchac, Louisiana.—Before improvement was commenced the Amite River and Bayou Manchac, its principal tributary, were navigable by the ordinary river steamboat below and for a short distance above their point of junction, but the navigation was very much impeded and endangered by snags, stumps, impending trees, etc.

In 1880 a project was adopted for the improvement of the Amite River, providing for a low-water channel 5 feet deep as far upstream as appropriations would permit, the main part of the work to be done above the mouth of the Bayou Manchac. An effort was made to do the work by contract, but the results were unsatisfactory, and in 1883 the original project was modified so as to permit the use of the Government plant and hired labor, the improvement to be made below the mouth of the Bayou Manchac.

Under the appropriation of September 19, 1890, the work of improvement was continued from July 1 to August 29, 1891, with the Government snagging plant. Obstructions were removed from the bayou between its mouth and Hope Villa, and from the river between its mouth and the junction with Bayou Manchac. The extent of channel improved during this time was about 13 miles.

July 13, 1892, an appropriation of $2,500 was made for maintenance, $1,000 of which was to be used to construct a turning basin for boats at or near the mouth of Wards Creek on Bayou Manchac.

As this sum, $1,000, was not deemed sufficient for dredging out a turning basin, it was held for further increase.

The snagging plant was thoroughly repaired, and with the remainder of the appropriation work was carried on from November 17 to December, 1892, between Wards Creek, on Bayou Manchac, to Port Vincent, on the Amite River, a distance of about 20 miles. This improvement gave much relief to the navigation of the river and bayou.

To June 30, 1894, the sum of $25,089 had been expended on the improvement of these streams. At that date the depth of water was sufficient, but the navigation was considerably hampered by obstructions which had formed since operations ceased in 1892.

August 17, 1894, Congress appropriated $2,500 for maintenance. With this money the snagging plant was again thoroughly repaired, and, after completing the work on the Tickfaw River, snagging operations were commenced February 18, 1895, at Wards Creek, on the Bayou Manchac, and continued down to the town of Cho on the Amite River, where the work ceased May 31, 1895. The distance improved was about 22 miles, and the number of obstructions removed was 5,019.

The contemplated turning basin for boats at the mouth of Wards Creek, on Bayou Manchac, was dredged out in January of the present year under contract.

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Navigation is now available for vessels drawing 5 feet from this point to the mouth of the Amite River.

The amount expended during the year ending June 30, 1895, was $3,190.32.

Owing to the caving of the banks of these streams, the permanent improvement is hardly possible, and about $2,500 will be required annually to keep them free of obstructions.

July 1, 1894, balance unexpended	$1,211.00
Amount appropriated by act of August 17, 1894	2,500.00
	3,711.00
June 30, 1895, amount expended during fiscal year	3,190.32
July 1, 1895, balance unexpended	520.68
July 1, 1895, outstanding liabilities	8.33
July 1, 1895, balance available	512.35
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	2,500.00

(See Appendix R 3.)

4. Bayou Lafourche, Louisiana.—Prior to 1879 the navigation of Bayou Lafourche was very much obstructed by snags, logs, raft heaps, impending trees, and wrecks.

In 1879 a project was approved for the removal of these obstructions, and work under this project was carried on until 1885.

In 1888 Congress appropriated $50,000 for the improvement of the bayou on the plan of Lieutenant Crosby, Corps of Engineers, dated June 11, 1886, and provided for dredging for the immediate relief of low-water navigation.

Lieutenant Crosby's project was for a lock at the head of the bayou connecting it with the Mississippi River, and subsequent dredging of the bayou channel to a width of 75 feet, with a depth of 5 feet at mean low water of the Gulf. The estimated cost was $450,000, with an annual expenditure of $8,000 for operation and maintenance.

The act of September 19, 1890, appropriated $50,000 for this stream and also provided for immediate dredging to secure low-water navigation.

On July 13, 1892, $50,000, and on August 17, 1894, $40,000 was appropriated for continuing improvement and removing obstructions.

Under the provision of the act of Congress of August 11, 1888, dredging was commenced at the head of the bayou and has been continued since at intervals. There had been expended on the improvement of this stream to June 30, 1894, $119,979.63, with considerable benefit to the low-water navigation. At that time flatboat navigation was rendered practicable during low water throughout the bayou.

Upon the subsidence of the high water in 1894 dredging operations were resumed on July 5 and continued until high water again caused a suspension of the work on April 5, 1895. During this time dredging was carried on from the mouth of the bayou to a point about 33 miles below Donaldsonville, La., and numerous snags, logs, stumps, and wrecks were removed from the channel, enabling planters to float their crops and merchandise during the entire period.

The amount expended on this work during the fiscal year ending June 30, 1895, was $21,951.17.

Dredging here is a very unsatisfactory method of improvement, as much of the work has to be gone over again after the subsidence of the

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flood in the Mississippi River. If the lock were constructed, whatever dredging was thereafter done would be practically permanent, and the certainty and safety of the navigation of the bayou assured.

During the past year the water in the Mississippi has been unusually low, with consequent low water in Bayou Lafourche over the shoal places, rendering steamboat navigation possible for but 123 days, flatboats being employed during the balance of the year. With the exception of the coal received through the bayou from Pittsburg, Pa., the steamboats handled but 52,648 tons of freight, 126,359 tons having been carried by flatboats, with the consequent increased expense of transportation.

It is greatly desired by all parties interested that the locks connecting the bayou with the Mississippi River be constructed, which would, it is claimed, within a few years cause a saving to the producers, carriers, and consumers of an amount equal to the total estimated cost of the locks.

July 1, 1894, balance unexpended	$60,020.37
Amount appropriated by act of August 17, 1894	40,000.00
	100,020.37
June 30, 1895, amount expended during fiscal year	21,951.17
July 1, 1895, balance unexpended	78,069.20
July 1, 1895, outstanding liabilities	190.00
July 1, 1895, balance available	77,879.20
Amount (estimated) required for completion of existing project	310,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix R 4.)

5. Bayou Terrebonne, Louisiana.—When work was commenced in 1880 Bayou Terrebonne was but little better than a drainage ditch, being about 11 feet wide when dredging began.

The project called for the dredging of a channel 4 feet deep at mean low water of the Gulf to Houma. The cost of the improvement of this bayou was estimated at $38,800. The completion of the work to Houma as projected cost $38,642.60, enabling planters to ship their merchandise to Houma, or else to New Orleans, by connecting bayous and canals.

The channel dredged by the United States has stood very well, but will require some attention in the near future to keep it in good condition.

The amount expended during the year ending June 30, 1895, was $1,077.84, which was applied to payment for extensive repairs made to the dredge.

July 1, 1894, balance unexpended	$1,236.74
June 30, 1895, amount expended during fiscal year	1,077.84
July 1, 1895, balance unexpended	158.90

(See Appendix R 5.)

6. Bayou Plaquemine, Grand River, and Pigeon bayous, Louisiana.—Previous to the closing of the mouth of Bayou Plaquemine by a dam, in 1867 or 1868, the largest steamboat passed through it into Grand Lake and the numerous water routes connected with it.

In 1885 a project was proposed for reestablishing this water route by building a lock at the head of the bayou and dredging out the channel below. In 1888 $100,000 was appropriated for improving the bayou

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and protecting the bank at its mouth from caving; $75,000 of this sum was allotted to bank protection at the mouth; the remainder was devoted to dredging out the bayou, so as to give a channel 60 feet wide and 6 feet deep at mean low-water level of the Gulf.

This dredging progressed until, at the end of June, 1891, it had nearly reached the railroad bridge. The cut was about 5 miles long and 30 feet wide, and $16,948.31 had been expended on this work at that time.

During the following fiscal year the dredging was continued until the bridge was reached, and since the draw in this bridge had not been completed the dredge turned back and widened the cut to 60 feet for a distance of about one-half mile from the bridge. The amount expended on this work during the year ending June 30, 1892, was $5,846.41.

The proposed channel is incomplete and, until the lock at the head of the bayou is built, of but little service to navigation and liable to deteriorate.

In 1890 $100,000 was appropriated for continuing the improvement. Of this sum $60,000 was allotted for bank protection at the mouth. A project for the expenditure of the remainder by commencing work upon the lock was presented, but as the lock proposed by a Board of Engineer Officers was estimated to cost $700,000, the sum available was held for increase by further appropriation by Congress.

In 1892 $150,000 was appropriated for continuing improvement, of which $10,000 was for improving Grand River and Pigeon bayous, forming a part of the Bayou Plaquemine route. An allotment of $72,000 was made from this appropriation for bank protection at Plaquemine.

The work of protecting the river bank was in the charge of Capt. John Millis, Corps of Engineers, until October 31, 1894, when it was transferred to Major Quinn.

This work was projected in 1888 for the purpose of securing the site of the proposed lock. It consists of spur dikes, above and below the lock site, with continuous revetment between dikes.

There had been expended on the entire work of improving Bayou Plaquemine to June 30, 1894, the sum of $290,087.56.

The work is effective and remains in good condition, requiring but little repair during the past year.

August 17, 1894, $110,000 was appropriated for continuing improvement, $10,000 of which was for removing obstructions in Grand River and Pigeon bayous. From this appropriation $20,000 was allotted for repairs that might be necessary to the river bank protection work.

During the year 1894 dredging was carried on in the bayou from January 11 to November 5, and resulted in excavating 135,934 cubic yards of material and removing numerous logs and stumps.

In 1893 work was also continued from August 17 to October 2 on the Grand River and Pigeon Bayou routes, removing 1,484 sunken logs and overhanging trees and 4½ miles of raft. With the funds appropriated August 17, 1894, work was resumed November 5 of that year and discontinued January 3, 1895, resulting in the removal of 32,535 cubic yards of material and 664 logs and stumps. The work was carried down to Grand Lake, a distance of about 25 miles, but the funds being nearly exhausted, the large shoal at this point was not entirely removed.

The completion of this work opens a competing steamboat route in connection with the Texas and Pacific Railway at Plaquemine, and has caused a reduction of about 33⅓ per cent in freight rates from the Teche.

Title to all the land needed for the lock at Plaquemine has been obtained. The buildings located on this property were sold at public auction and the proceeds of sale turned into the Treasury.

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With the money appropriated August 17, 1894, there are sufficient funds with which to build a cofferdam and commence the foundation for the lock, and under approved project preliminary work is now in progress.

The amount expended on the improvement of Bayou Plaquemine during the year just closed was $19,617.75.

Since the partial dredging of Bayou Plaquemine in 1893, the bayou has been navigated by large steamboats and the number increases each year. Regular and certain communication with the Bayou Teche during the sugar-grinding season has been established and has resulted in a considerable reduction of freight rates. It is asserted by shippers and carriers that business will steadily increase as work on the projected lock at Plaquemine progresses, and, with the completion of the lock, nearly all of the crops and supplies for five of the richest and largest producing parishes bordering on these waterways will go by this route with great saving in time and cost of transportation.

The money statement following is for the entire work of improving Bayou Plaquemine:

July 1, 1894, balance unexpended	$59,915.02
Amount appropriated by act of August 17, 1894	110,000.00
	169,915.02
June 30, 1895, amount expended during fiscal year	19,617.75
July 1, 1895, balance unexpended	150,297.27
July 1, 1895, outstanding liabilities	165.32
July 1, 1895, balance available	150,131.95
Amount (estimated) required for completion of existing project	1,248,250.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	150,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix R 6.)

7. *Bayou Courtableau, Louisiana.*—At the time of the adoption of the present project the backwater from the Atchafalaya River formed a large sand deposit, known as Little Devil Bar, at the mouth of the Courtableau.

The approved project of 1880 contemplated the closing of some run-out bayous in order to confine the water in the Courtableau and cause its current to wash out the bar at its mouth; after this was accomplished, then to construct a timber lock and dam to give slack-water navigation to Washington, La. In 1883 the estimate was increased to $78,500, and provided for a masonry lock.

In 1890 $2,200 was appropriated. With this money work was commenced September 8, 1891, and continued until November 20 of that year, using the Government plant and hired labor. During this time the dams at bayous Cane, Mamzelle, and Big Fordoche were all repaired with piles and sheet piles, brush aprons being placed above and below them, and all were left in good condition.

Little Devil Bar is still an obstruction to the navigation of Bayou Courtableau, and frequently it is so late in the season before steamboats can pass over this bar that the crops and supplies have to be moved by other and more expensive means of transportation.

It is considered doubtful if, with all the run-out bayous closed, a channel navigable at low water can be maintained over this bar which, under any circumstances, will certainly form at each high water of the Atchafalaya.

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Up to June 30, 1894, the sum of $31,036.48 had been expended in closing run-out bayous, with the effect of partially removing the bar.

August 17, 1894, Congress appropriated $5,000 for continuing the improvement.

As but little work has been done since 1891, the dams are all in bad condition, and the funds now available will be applied to thoroughly repairing the dams across Fordoche, Mamzelle, Big and Little Cane bayous, and, if possible, to close the small bayous between bayous Mamzelle and Big Cane. Proposals for furnishing a suitable plant for this work were opened June 27, 1895.

The sum of $22.50 was expended on the improvement of this bayou during the year just closed.

The success of the dams so far built appears to warrant their maintenance and the permanent closure of the remaining run-out bayous.

There seems to be sufficient water in the bayou to wash out the bar at its mouth, formed by the backwater of the Atchafalaya, if it can be held within the banks which the closure of the run-out bayous by dams appears to effect.

July 1, 1894, balance unexpended	$163.52
Amount appropriated by act of August 17, 1894	5,000.00
	5,163.52
June 30, 1895, amount expended during fiscal year	22.50
July 1, 1895, balance unexpended	5,141.02
July 1, 1895, outstanding liabilities	20.50
July 1, 1895, balance available	5,120.52

(See Appendix R 7.)

8. *Bayou Teche, Louisiana.*—Previous to improvement the bayou had a navigable depth of about 8 feet, but the channel was obstructed by snags, logs, impending trees, and wrecks.

The project adopted contemplated the removal of these obstructions, and money having been appropriated the stream was thoroughly cleared from Port Barre down.

In 1886 this work was completed, but further obstructions had formed in the bayou since then, and in 1890 an appropriation of $5,000 was made with which to accomplish their removal, the work to be confined to that portion of the stream between the mouth and St. Martinville.

Work under this appropriation was commenced by hired plant on October 12, 1891, and continued until December 10 of that year, resulting in the improvement of about 59 miles of channel from St. Martinville down, and giving much relief and satisfaction to the commerce of the bayou.

The amount expended on the improvement of this stream to June 30, 1894, was $54,435.01.

At that time the bayou was obstructed by bars which had formed by material washed into the channel by drainage ditches, on which, at times during low water, there was not more than 3 feet depth. Other obstructions, such as sunken logs, fallen trees, and wrecks, had also formed since the improvement in 1891.

Under the appropriation of $6,000 made August 17, 1894, for continuing improvement, these obstructions were removed. The work was commenced, under contract, February 4, 1895, at Loreauville, and continued to a point about 2 miles below Franklin, where operations were discontinued May 7, 1895, owing to exhaustion of funds. The distance improved was about 70 miles.

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The channels through the bars now have a depth of 8 feet at low water and a width of fully 50 feet.

The improvement can not be considered permanent, as obstructions re-form.

The amount expended during the year ending June 30, 1895, was $6,499.37, making a total since the commencement of the improvement of $60,934.38.

Interested parties have expressed satisfaction with the dredging work recently done in the bayou, and declare its navigable condition for all purposes much improved, but further dredging is desired, particularly in the vicinity of New Iberia and above to Breaux Bridge.

It is greatly desired to have the Bayou Plaquemine route opened by means of locks connecting the bayou with the Mississippi River, as the shipping facilities afforded and the amount which would be saved in freights by the completion of this work will be of very great benefit. The improvements already made have secured a competition which has resulted in reducing rates on sugar alone, in barrels, from 60 to 30 cents.

July 1, 1894, balance unexpended	$564.99
Amount appropriated by act of August 17, 1894	6,000.00
	6,564.99
June 30, 1895, amount expended during fiscal year	6,499.37
July 1, 1895, balance unexpended	65.62
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	6,000.00

(See Appendix R 8.)

9. Channel, bay, and passes of Bayou Vermilion, Louisiana.—Bayou Vermilion was at one time navigated throughout its length, but since the construction of the Southern Pacific Railroad the navigation has been confined to that portion below the railroad bridge.

A preliminary examination of the bayou, bay, and passes was made in January, 1891. At that time the upper 12 miles of the bayou had not a navigable depth of much over 2 feet, and below that the depth was not less than 5½ feet through the bayou, bay, and passes. The width of the bayou was from 100 to 400 feet.

The approved project of 1892 contemplated the removal of obstructions, such as snags, sunken logs, and impending trees in the bayou, and the marking of the channel through the bars in the bay with guide piles. The estimated cost of the improvement, to provide for 5½ feet depth of water up to the railroad bridge, was $25,000.

July 13, 1892, Congress made an appropriation of $7,500 for this work. Work under contract was commenced December 1, 1892, at a point 18 miles above the mouth, improving 37½ miles of channel and securing a depth of 5½ feet over that portion of the channel improved by removing snags, logs, overhanging trees, and other obstructions.

The snagging part of the contract was completed March 9, 1893, and by reason of the force and violence of the elements an extension of time was granted the contractor for driving the guide piles in Vermilion Bay, the same being completed July 25, 1893.

There had been expended on this work to June 30, 1894, the sum of $7,054.19.

A recent examination shows the work to be in good condition.

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An appropriation of $5,000 was made August 17, 1894, for continuing the improvement, with which it is proposed to clear the stream above Abbeville as far as may be possible.

The amount expended on this improvement during the year just closed was $26.88.

The contractor commenced work June 3, 1895, and up to the 30th of that month had removed 489 obstructions.

During the past year a steamboat made regular trips from Bayou Vermilion through to New Orleans, via the Larompe River, Grand Lake, and Atchafalaya and Mississippi rivers, which is the first time in many years that a steamer has been so employed. Although this route is a long and circuitous one, freight is carried cheaper than by the former route, part water and part rail.

It is confidently claimed that with the opening of the Bayou Plaquemine route by means of locks connecting it with the Mississippi River, the time and cost of transportation will be so reduced that nearly all shipments will go by this route.

July 1, 1894, balance unexpended		$445.81
Amount appropriated by act of August 17, 1894		5,000.00
		5,445.81
June 30, 1895, amount expended during fiscal year		26.88
July 1, 1895, balance unexpended		5,418.93
July 1, 1895, outstanding liabilities	$1,675.33	
July 1, 1895, amount covered by uncompleted contracts	3,240.00	
		4,915.33
July 1, 1895, balance available		503.60

Amount (estimated) required for completion of existing project	12,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	1,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix R 9.)

10. Mermentau River and tributaries, Louisiana.—A survey of this river, including its tributaries and course through Lake Arthur and Grand Lake to the Gulf of Mexico, was made in 1891. At that time the least depth at Viterboville and for a distance of 5 miles below that point was 7 feet; thence to Lake Arthur the depth was not less than 30 feet. Through Lake Arthur the channel had a minimum depth of 7 feet. From Lake Arthur to Grand Lake the least depth was 24 feet. Through Grand Lake the uniform depth was 6 feet. Immediately below Grand Lake the river was 30 feet deep, but the depth from that point to the mouth gradually decreased. At the mouth, inside, the depth was 13 feet. About 5 miles above the mouth, at the head of a lake, occurred a shoal, through which a channel of 7 feet was found, available for steamers, but too crooked for sailing vessels, as there was but 5 feet over the flats. All the soundings were referred to mean low tide in the Gulf.

The stream had a width of 70 feet at Viterboville and maintained the same width for a distance of 7 or 8 miles, where it gradually began to widen, until at the mouth of the Nezpique it attained a width of 250 feet. From that point to Lake Arthur the Mermentau River was generally 350 feet wide.

In 1892 a project was approved which contemplated the removal of obstructions, such as logs, snags, and overhanging trees in the upper river and a mud flat in the lower, the removal of this flat to be accom-

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plished by brush wing dams. The cost of improving this stream from Viterboville, on the Nezpique, to the mouth of the Mermentau River was placed at $23,615.25.

July 13, 1892, an appropriation of $7,500 was made for this improvement.

Work under this appropriation was commenced December 8, 1892, with hired plant under contract at the lower end of Lake Arthur, and was carried on up the Mermentau River, improving about 38 miles of channel by removing snags, overhanging trees, etc., materially lessening the dangers of navigation on that portion of the stream which is most used. Work ceased on March 7, 1893.

The amount expended on this work to the close of the year ending June 30, 1894, was $7,076.11.

At that time the work done remained in good condition.

At present it is desired to deepen the water at the Gulf entrance to the river and also to increase the depths of the channels through Mud Lake.

August 17, 1894, $5,000 was appropriated for continuing the improvement, but as it is not deemed prudent to undertake work with so small an amount of money a project was submitted January 17, 1895, recommending that the available funds be held for increase.

There has been expended on this work during the year just closed $39.33.

July 1, 1894, balance unexpended	$423.89
Amount appropriated by act of August 17, 1894	5,000.00
	5,423.89
June 30, 1895, amount expended during fiscal year	39.33
July 1, 1895, balance unexpended	5,384.56
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	11,115.25

(See Appendix R 10.)

11. Mouth and passes of Calcasieu River, Louisiana.—Previous to improvement there was not to exceed 3 feet depth over the bars in Calcasieu Lake.

In 1888 $10,000 was appropriated for this work, but as the permanency of the channels required that they be protected by a revetment of some kind this sum was deemed as entirely too small and was held for further increase.

In 1890 $75,000 was appropriated for the improvement of the mouth of the Calcasieu River, but as the kind of construction indicated in the act could not be safely undertaken with so small a sum it was also held for further increase.

The approved project contemplates the dredging of suitable channels 12 feet deep through the head and foot of Calcasieu Lake and revetting these channels to prevent the return of the dredged material, and to build parallel piers of brush and stone at the entrance to the outer pass extending from the shore on either side to the deep water of the Gulf, and to dredge between these piers if necessary. The estimated cost of the improvement was placed at $600,000.

In 1892 $100,000 was appropriated for the improvement of the river and pass, and contracts were accordingly let for the construction of a jetty upon the east side of the channel across the bar in the Gulf and for the construction of a revetment to protect a channel to be dredged through the bar at the head of the pass.

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Bids were invited for the dredging, but none were received which were deemed reasonable, and accordingly this work was authorized to be done with the dredge belonging to the Government.

The 10,000 linear feet of the revetment in Calcasieu Lake was completed August 6, 1893, but was afterwards damaged considerably by storm in November of that year, and $3,102.80 was expended in its repair. By a subsequent storm much damage was done to the structure, which will necessitate further repairs.

Dredging was commenced in July, 1893, and continued until February following, when the dredge was hauled out and thoroughly repaired.

The total amount expended on the improvement to June 30, 1894, was $142,206.35.

The east jetty contract was completed August 11, 1894, and the jetty has now a total length of 7,347 feet.

Dredging at the foot of Calcasieu Lake was resumed in August, 1894, and continued until the completion of the channel in December following.

August 17, 1894, $90,000 was appropriated for continuing the improvement.

With the funds available dredging operations are being applied to the channel at the head of Calcasieu Lake, and, under contract entered into November 20, 1894, it is proposed to cap with stone 7,000 feet of the east jetty, or so much thereof as may be possible with the available money, so as to bring it 2 feet above mean high tide. The contractor commenced this work on January 28, 1895, and to June 30, 1895, had placed 5,652 linear feet of capping.

The amount of material dredged during the year just closed amounted to 196,509 cubic yards.

The jetty so far completed affords a protection sufficient for the scouring out of a reasonably straight channel across the bar, which had a depth of over 7 feet at the time of the last survey, and reports received since that time indicate that the channel depth exceeds this amount.

It is believed that if sufficient funds remain to complete the proposed dredging a channel 60 feet wide and 8 feet deep from deep water in the river to deep water in the lake will be secured. The channel already dredged maintains itself and has resulted in considerable benefit, but it is not believed to be possible to preserve the channel for any great length of time without properly revetting it so as to prevent the waves from carrying material into it and filling it up.

July 1, 1894, balance unexpended		$56,955.54
Amount appropriated by act of August 17, 1894		90,000.00
		146,955.54
June 30, 1895, amount expended during fiscal year		85,743.40
July 1, 1895, balance unexpended		61,212.14
July 1, 1895, outstanding liabilities	$17,019.45	
July 1, 1895, amount covered by uncompleted contracts	18,149.91	
		35,169.36
July 1, 1895, balance available		26,042.78

Amount (estimated) required for completion of existing project 335,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897 ..... 100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix R 11.)

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12. Harbor at Sabine Pass, Texas.—Originally there was scarcely 6 feet depth of water on the bar at the entrance to Sabine Pass, and as the bar was composed of very soft mud all efforts to maintain a channel through it of 12 or 16 feet depth by dredging were unavailing.

In 1882 a project for the improvement of this entrance was approved. It provided for the construction of jetties on either side of a channel connecting the deep water of the pass with that of the Gulf.

The estimated cost of this improvement was $3,177,606.50.

Since the approval of this project there has been appropriated $1,723,750. A total of $1,716,091.96 had been expended to June 30, 1894, of which sum $1,396,091.96 was expended under the present project.

The east jetty had then a length of 17,100 feet, 16,615 feet of which had been raised to 2 feet above mean high water and 35 feet up to mean low water. The outer 450 feet consisted of foundation work only.

The west jetty at that date had a length of 12,840 feet, 6,609 feet of which had been raised to 2 feet above mean high water, and the remainder only built to the level of mean low water, and was incomplete.

The channel between jetties was at that time 16 feet deep at mean low tide from deep water in the pass to the 17-foot contour of depth in the Gulf, and was 100 feet wide.

By the act of Congress of August 17, 1894, $275,000 was appropriated for continuing the improvement, and, under contracts, work of extending the east jetty and dredging between the jetties was commenced in March of the present fiscal year.

During the year just closed the contractor added to the east jetty 6,434 tons of riprap stone and 13,294.43 square yards of brush mattress.

The amount of material dredged during the year under the present contract amounted to 155,669 cubic yards.

The west jetty is now 14,875 feet long, 6,609 feet of which is raised to 2 feet above mean high water and 7,966 feet is brought up to mean low water. The outer 300 feet is foundation work only.

The east jetty had at the close of the present fiscal year a total length of 18,465 feet, 16,615 feet of which was raised to 2 feet above mean high water, the balance being uncompleted work.

The channel between the jetties has maintained its depth of 16 feet, except for a very short distance beyond the ends of the jetties, where a very slight deficiency occurred. It is apparent, however, that a very considerable deepening has taken place throughout the channel, and it is a common occurrence for vessels drawing 16 feet to pass the channel, and in one instance a schooner drawing 18.9 feet passed safely through and without delay, which is evidence of the practicability of the channel.

The jetties remain in good condition, there being only an apparent settlement since the last survey of 0.5 of a foot, and no settlement has taken place in either the rock section or the concrete survey station. Some of the loss in height is due to the displacement of rock by wave action, and some money for the preservation of the jetties during the time of construction, as well as after completion, will be required.

Great, but not complete, protection to the dredged channel will be afforded by the completion of that portion of the east jetty now under contract. The work should be extended to the limit projected.

The west jetty is yet in an unfinished state, and should be capped with stone, as designed, in order to be safe.

In the beginning the jetties were built of alternate layers of brush and stone, but the rapid disappearance of the brush led to the adoption of the present method, which is, first to lay a brush mat and then build a riprap structure on this reaching 2 feet above mean high water.

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The amount expended on this improvement during the fiscal year just closed was $62,952.56.

July 1, 1894, balance unexpended		$52,658.04
Amount appropriated by act of August 17, 1894		275,000.00
		327,658.04
June 30, 1895, amount expended during fiscal year		62,952.56
July 1, 1895, balance unexpended		264,705.48
July 1, 1895, outstanding liabilities	$29,558.66	
July 1, 1895, amount covered by uncompleted contracts	216,019.25	
		245,577.91
July 1, 1895, balance available		19,127.57

Amount (estimated) required for completion of existing project	1,453,856.50
Amount that can be profitably expended in fiscal year ending June 30, 1897	275,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix R 12.)

13. Sabine River, Texas.—When the improvement of the river was commenced there was a depth of 3½ feet on the bar at its mouth, and also above the town of Orange.

Logs, snags, etc., above here interfered with navigation. To June 30, 1889, there had been appropriated for this work $34,700, of which $30,760.39 had been expended.

In 1880 a channel 6 feet deep and from 70 to 100 feet wide was dredged through the bar. In 1881 several small cuts, to avoid bends obstructed by logs, were made above Orange.

An examination above Orange showed many snags in parts of the channel, and a project was prepared and contract entered into for the expenditure of the remaining balance in closing both branches of Old River at the head of the Narrows with pile, brush, and earth dams, to throw all the water in the useful channel, and removing the obstructions, such as snags, overhanging trees, etc.

The smaller Old River channel was closed and most of the piles driven for the larger dam, when a sudden rise washed out many piles in the latter. The river remaining so high that satisfactory work could not be done, the contract was extended to the next low-water season.

Work was resumed in September, 1890, and the dams finished, as projected, in December following, completing the project.

Under provisions of the river and harbor act of September 19, 1890, an examination of this river from Sabine Lake to Sudduths Bluff was made and a project submitted providing for the removal of obstructions from the river between these points, at an estimated cost of $10,000.

July 13, 1892, Congress appropriated $5,000 for improving Sabine River up to Sudduths Bluff, Texas, under which appropriation snagging operations were commenced under contract July 1, 1893, at a point 18 miles above Orange, and completed September 26, 1893, improving 17½ miles of channel by the removal of 1,325 obstructions.

The amount expended on the improvement of this river to June 30, 1894, was $39.531.97.

The act of August 17, 1894, appropriated $5,000 for completion of the project. The approved plan under this appropriation contemplates the completion of the improvement up to Sudduths Bluff, and also the removal of obstructions which have re-formed in the cleared channel above Morgans Bluff. Accordingly, contract was entered into for the

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removal of the most serious obstructions between Morgans Bluff and Sudduths Bluff, the same having been approved February 26, 1895, the work to be commenced on July 1, 1895.

The dredged channel over the bar at the mouth of the river is somewhat obstructed by snags, logs, etc., and the depth is now insufficient for the present demands of commerce. For the dredging and deepening of this channel $4,000 was allotted by the sundry civil act of March 2, 1895, from the appropriation for improvement of Sabine Pass, Texas.

During the fiscal year ending June 30, 1895, the sum of $83.47 was expended on this improvement.

After the obstructions in the river between its mouth and Sudduths Bluff are removed about $2,000 will be required annually to keep the stream in navigable condition.

July 1, 1894, balance unexpended	$168.03
Amount appropriated by act of August 17, 1894	5,000.00
	5,168.03
June 30, 1895, amount expended during fiscal year	83.47
July 1, 1895, balance unexpended	5,084.56
July 1, 1895, amount covered by uncompleted contracts	4,500.00
July 1, 1895, balance available	584.56
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	2,000.00

(See Appendix R 13.)

14. Neches River, Texas.—Before this river was improved the bar at its mouth had only 3 feet of water over it, and navigation was obstructed between Yellow Bluff and Bevilport by snags and fallen trees.

The project adopted for the improvement of this river called for the dredging of a channel over the bar at its mouth and the removal of obstructions from the river between Yellow Bluff and Bevilport.

In 1880 a channel was dredged through the bar at the mouth of the river 5 feet deep and 30 to 60 feet in width. In 1882 the river between Yellow Bluff and Bevilport was cleared of obstructions.

The bar at the mouth had again shoaled, so that at extreme low water there was only a navigable depth of about 3 feet. The channel was again dredged to a depth of 5 feet by the Government dredge, which had been at work at Calcasieu Pass, and the work was completed in April, 1889, since which time no work has been done.

The bar has again shoaled to a depth of 4 feet. On account of the increased shipments of lumber from Beaumont to Sabine Pass, Tex., owing to the increased depth of water secured at the latter place, this depth is insufficient for the needs of the increased commerce, and, with a view to its improvement, a project contemplating a channel about 100 feet wide and fully 8 feet deep from deep water in the Neches River to deep water in Sabine Lake was approved March 29, 1895, the work to be done with the Government dredge after completing the channel through the bar at the mouth of Sabine River, Texas.

The sum of $33,000 has been appropriated for the improvement of this stream, of which $28,842.16 had been expended to June 30, 1894.

July 1, 1894, balance unexpended	$4,157.84
July 1, 1895, balance unexpended	4,157.84

(See Appendix R 14.)

15. Removing sunken vessels or craft obstructing or endangering navigation.—Under date of June 4, 1895, the Secretary of War authorized

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the removal of the wreck of the steamer *Queen of the West*, lying in Grand Lake, Louisiana, and allotted therefor $1,200 from the permanent indefinite appropriation for removing sunken vessels or craft obstructing or endangering navigation.

It is proposed to accomplish the removal of this wreck under contract, and preliminary work is now in progress.

(See Appendix R 15.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations of the following localities, required by the act of August 17, 1894, were made by the local engineer, Maj. J. B. Quinn, Corps of Engineers, and reports thereon submitted through the division engineer, Col. C. B. Comstock, Corps of Engineers:

1. Preliminary examination of Bayou Bonfuca, in St. Tammany Parish, La.—Major Quinn submitted report of examination January 22, 1895. He regards the bayou as worthy of improvement, and estimates that the survey necessary for preparation of plan of improvement, with estimate, will cost $700. The division engineer is of opinion that the bayou is worthy of improvement to a small extent, and his views are concurred in by this office. The report was transmitted to Congress and printed in House Ex. Doc. No. 273, Fifty-third Congress, third session. (See also Appendix R 16.)

2. Preliminary examination of Chefuncte River and Bogue Falia, Louisiana.—Major Quinn submitted report of examination January 24, 1895. He is of opinion, concurred in by the division engineer and by this office, that these streams are worthy of improvement by the General Government. It is estimated that the survey necessary to the preparation of plan of improvement, with estimates, will cost $2,500. The report was transmitted to Congress and printed in House Ex. Doc. No. 274, Fifty-third Congress, third session. (See also Appendix R 17.)

3. Preliminary examination of Tickfaw River and tributaries, Louisiana.—Major Quinn submitted report of examination January 28, 1895. He considers the Tickfaw and Natalbany rivers to be worthy of improvement, and estimates that the survey necessary for preparation of project for improvement, with estimates, will cost $1,500. The division engineer regards this stream as worthy of improvement to a small extent, and his views are concurred in by this office. The report was transmitted to Congress and printed in House Ex. Doc. No. 284, Fifty-third Congress, third session. (See also Appendix R 18.)

4. Preliminary examination of Bayou Teche, Louisiana, from St. Martinville to Port Barre.—Major Quinn submitted report of examination January 22, 1895. He regards the locality as worthy of improvement, provided this can be done at moderate cost, and estimates that the survey necessary for preparation of plan of improvement, with estimate, will cost $1,500. The division engineer is of opinion that the bayou is worthy of improvement to a moderate extent, and his views are concurred in by this office. The report was transmitted to Congress and printed in House Ex. Doc. No. 272, Fifty-third Congress, third session. (See also Appendix R 19.)

5. Preliminary examination of channel through Sabine Lake, Texas, from the mouth of the Sabine and Neches rivers to the head of the pass from said lake to the Gulf of Mexico.—Major Quinn submitted report of examination January 24, 1895. In his opinion, concurred in by the division engineer and by this office, the locality is worthy of improvement by the General Government. It is estimated that the survey

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necessary to the preparation of plan of improvement, with estimates, will cost $2,500. The report was transmitted to Congress and printed in House Ex. Doc. No. 275, Fifty-third Congress, third session. (See also Appendix R 20.)

EXAMINATION OF BATON ROUGE HARBOR, AND OF HARBOR AT BAYOU SARA, LOUISIANA, MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations of the following localities, required by the act of August 17, 1894, were made by the local engineer, Capt. John Millis, Corps of Engineers, and reports thereon submitted through the division engineer, Col. C. B. Comstock, Corps of Engineers.

1. Preliminary examination of Baton Rouge Harbor, Louisiana.—Captain Millis submitted report of examination September 21, 1894. In his opinion, concurred in by the division engineer and by this office, this harbor is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 71, Fifty-third Congress, third session. (See also Appendix S 1.)

2. Preliminary examination of harbor at Bayou Sara, Louisiana.—Captain Millis submitted report of examination September 21, 1894. In his opinion, concurred in by the division engineer and by this office, the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 63, Fifty-third Congress, third session. (See also Appendix S 2.)

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN TEXAS.

This district was in the charge of Maj. A. M. Miller, Corps of Engineers, having under his immediate orders Capt. Lansing H. Beach, Corps of Engineers, to October 29, 1894, and Lieut. William V. Judson, Corps of Engineers, since November 17, 1894; Division Engineers, Col. C. B. Comstock, Corps of Engineers, to February 3, 1895, and Col. H. M. Robert, Corps of Engineers, since February 5, 1895.

1. Entrance to Galveston Harbor, Texas.—The obstructions to deep-water navigation at this harbor have been the outer and inner bars. On the former the natural depth was 12 feet, and on the latter about 13 feet, both at mean low tide.

The present project for improvement at this locality was adopted in 1874, modified in 1880, and again modified in 1886, the object being to deepen the channel so as to admit seagoing vessels of the deepest draft. The projects prior to 1874 related to dredging operations on a small scale.

The projects of 1874 and 1880 contemplated construction of jetties to deepen the channel on the bar, the former with a view to a depth of 18 feet. The modification of 1886 has in view a possible depth of 30 feet by means of jetties, to be supplemented, if need be, by dredging; these jetties to be of rock and to be built to a height of 5 feet above mean low tide. The cost of the modification of 1886 (the present project) was estimated at $7,000,000.

The total amount expended under the foregoing plans to June 30, 1894, was $4,368,346.50, in addition to which there was expended $100,000 subscribed by the city of Galveston in 1883. There was then a depth at mean low tide of 14½ feet on the outer bar and 24¼ feet where the inner bar was, an increase of 2½ feet and 11½ feet, respectively, since the work began.

The expenditure during the fiscal year ending June 30, 1895, of $1,222,623.99 has resulted in obtaining 17¾ feet on the outer bar, an increase in depth of 3¼ feet since last year.

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The work during the year consisted in extending the north jetty gulfward 6,300 feet, and in completing 8,500 feet of this jetty in repairing and partly rebuilding the south jetty trestle preparatory to extending this jetty gulfward, and in supplementing the action of the jetties by dredging.

The total amount of work done since operations began in 1887 is represented by 32,829 feet of south jetty, of which 32,000 feet is completed, and 22,500 feet of north jetty, of which 18,500 feet is completed. The amount of material dredged was 68,071 cubic yards.

July 1, 1894, balance unexpended		$459,653.50
Amount appropriated by sundry civil act approved August 18, 1894		600,000.00
Amount appropriated by general deficiency act approved January 25, 1895		200,000.00
Amount appropriated by sundry civil act approved March 2, 1895		1,160,000.00
		2,419,653.50
June 30, 1895, amount expended during fiscal year		1,222,623.99
July 1, 1895, balance unexpended		1,197,029.51
July 1, 1895, outstanding liabilities	$157,311.27	
July 1, 1895, amount covered by uncompleted contracts	978,331.63	
		1,135,642.90
July 1, 1895, balance available		61,386.61
Amount (estimated) required for completion of existing project		1,690,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		1,690,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix T 1.)

2. Ship channel in Galveston Bay, Texas.—This is a channel dredged through Galveston Bay by the United States Government from Bolivar Channel to Morgan Cut, the latter terminating at a point 4.8 miles from Morgan Canal, an excavation across Morgan Point at the mouth of the San Jacinto River. Morgan Cut and Canal were formerly the property of the Buffalo Bayou Ship Channel Company, but were purchased by the United States, and the transfer was made May 4, 1892.

The natural depth on the line of the Galveston Bay Ship Channel averaged 8½ feet at mean low tide, with a depth in some places of but 7 feet; the ruling depth in Morgan Cut was 7½ feet, and in the canal 17 feet.

The project for this improvement was adopted in 1871, modified in 1877, and again modified in 1892. This latter modification became necessary owing to the acquisition by the United States of the Morgan Cut and Canal. The object of the improvement is to excavate and maintain a channel, 100 feet wide at the bottom and 12 feet deep, from Bolivar Channel to the San Jacinto River, a distance of 24.33 miles, thereby giving an outlet to the commerce of Buffalo Bayou, of San Jacinto River, of Trinity River, and of Cedar Bayou.

The amount expended to June 30, 1894, was $597,648.58, and was applied to dredging a channel, 100 feet wide and 12 feet deep, from Bolivar Channel to the Morgan Cut, in widening and deepening the Morgan Cut, and in protecting the banks of the Morgan Canal. The available depth in the channel was 9.5 feet at the close of the last fiscal year, the width being from 75 to 100 feet.

During the present year the amount expended was $51,858.28, and was applied to widening the Morgan Cut from 75 to 150 feet and in deepening it in the center from 9.5 to 12 feet over part of its length.

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The available depth remains the same as last year, but the channel is considerably wider.

This project is not capable of permanent completion, as the shifting sand in the bay causes the channel to shoal considerably when work is suspended; it will therefore require an annual appropriation to maintain the channel after its completion.

July 1, 1894, balance unexpended		$28,851.42
Amount appropriated by act of August 17, 1894		50,000.00
		78,851.42
June 30, 1895, amount expended during fiscal year		51,858.28
July 1, 1895, balance unexpended		26,993.14
July 1, 1895, outstanding liabilities	$8,826.29	
July 1, 1895, amount covered by uncompleted contracts	16,869.07	
		25,695.36
July 1, 1895, balance available		1,297.78
Amount (estimated) required for completion of existing project		219,675.44
Amount that can be profitably expended in fiscal year ending June 30, 1897		100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix T 2.)

3. Channel in West Galveston Bay, Texas.—The natural depth in this bay was from 2½ to 3 feet. A channel with a depth of 5 feet was dredged through it in 1859 by the State of Texas, but the storm of 1875 caused it to shoal until the depth was again about 3 feet, and at the same time made it too narrow for navigation purposes. Subsequent storms probably caused further filling of the channel.

The project for improving this bay was adopted in 1892, and consisted in widening, deepening, and straightening the channel by dredging, so as to afford a least width of 200 feet and depth of 3½ feet between the railroad bridges and San Luis Pass in the bay, and a least width of 100 feet and depth of 3 feet along Christmas Point, the channel to be suitably marked by beacons.

The amount expended to June 30, 1894, was $6,067.53, and was used in dredging a channel 100 feet wide and 3½ feet deep across Deer Islands Reef, this channel having been nearly completed.

During the present year $7,341.33 was expended in completing the Deer Islands Channel and in dredging a channel at Karonkaway Reef 100 feet wide and 4 feet deep.

A good channel, 100 feet wide and 3½ feet deep, is now available for vessels through the greater part of the bay.

July 1, 1894, balance unexpended		$8,932.47
Amount appropriated by act of August 17, 1894		5,000.00
		13,932.47
June 30, 1895, amount expended during fiscal year		7,341.33
July 1, 1895, balance unexpended		6,591.14
July 1, 1895, outstanding liabilities	$1,348.91	
July 1, 1895, amount covered by uncompleted contracts	4,287.63	
		5,636.54
July 1, 1895, balance available		954.60
Amount (estimated) required for completion of existing project		9,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		9,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix T 3.)

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4. Trinity River, Texas.—This stream discharges into Galveston Bay through several mouths or passes. Opposite each of these a bar exists, over which there is a depth of but 3.5 feet at mean low tide, which is not sufficient for purposes of navigation, at least 5 feet of water being required.

The project, adopted for the improvement of this stream in 1873 and amended in 1889, contemplated the erection of two parallel jetties at the mouth of the middle pass, the one principally used by vessels, extending 7,750 feet into Galveston Bay and placed about 275 feet apart, and in closing the other passes by submerged dams, the object being to obtain 6 feet of water on the bar at mean low tide.

The amount expended to June 30, 1894, was $65,184.76. Of this sum part was applied to constructing jetties at the mouth of the middle pass, the respective lengths at the close of the last fiscal year being, west jetty, 7,359 feet, and east jetty, 300 feet. The balance of the money was spent in dredging a channel across the bar having a width of 100 feet and depth of 5 feet at mean low tide.

The amount expended during the fiscal year ending June 30, 1895, was $3,732.50, and was principally applied to making a survey of the river from Magnolia to Dallas, in accordance with the requirements of the last river and harbor act making appropriation for this stream.

The condition of the channel remains about the same as at the end of the last fiscal year. This channel is ample for navigation purposes; in order, however, to preserve it, it will be necessary to extend the east jetty out to the 5-foot contour in the bay.

July 1, 1894, balance unexpended	$1,815.24
Amount appropriated by act of August 17, 1894	5,000.00
	6,815.24
June 30, 1895, amount expended during fiscal year	3,732.50
July 1, 1895, balance unexpended	3,082.74
July 1, 1895, outstanding liabilities	172.50
July 1, 1895, balance available	2,910.24

Amount (estimated) required for completion of existing project	20,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix T 4.)

5. Cedar Bayou, Texas.—The navigation on this stream was obstructed by a bar which had formed at the mouth of the bayou where it empties into Galveston Bay. The depth of water in the bayou above the mouth was 7 feet, and in the bay beyond 5 feet, whereas the natural depth on the bar was but 3 feet.

The project adopted for this improvement consisted in the construction of two stone and brush jetties about 250 feet apart, and extending from the mainland to the 5-foot contour in Galveston Bay. These jetties were to protect a channel 5 feet deep and 100 feet wide connecting the 5-foot curve in the bayou with the 5-foot curve in the bay.

The amount expended to June 30, 1894, was $32,500, which was applied to dredging a channel 2,830 feet long, 90 feet wide, and 5 feet deep across the bar and in the partial construction of jetties to preserve it.

No work was done during the fiscal year, no funds being available for that purpose.

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The condition of the channel remains practically the same as at the end of the last fiscal year.

Amount (estimated) required for completion of existing project	$6,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

(See Appendix T 5.)

6. Buffalo Bayou, Texas.—The channel of this stream between the city of Houston and Simms Bayou, a distance of 11 miles, was, in its natural condition, narrow and tortuous, and the depth in many places not more than 5 feet; below Simms Bayou it was wide and deep.

The project for its improvement was adopted in 1881, the object being to straighten the channel, widen it to 100 feet, and deepen it to 12 feet; also to remove such snags, stumps, and overhanging trees as were obstructions to navigation.

The amount expended to June 30, 1894, was $193,139.49, and it resulted in clearing the channel of the most prominent stumps, snags, and overhanging trees, in easing the bends, and in removing such shoals as obstructed navigation, a 10-foot channel being then available from Houston to Harrisburg, and an 8-foot channel from Harrisburg to the mouth.

Although a contract for dredging, etc., had been entered into, practically no work was accomplished during the fiscal year, due principally to the insufficient plant of the contractors. The amount expended was $1,502.29.

The channel has shoaled to 8 feet between Harrisburg and Houston on account of surface wash from the banks, and directly at Houston the shoaling has been much greater, owing to the sewage of the town being carried into the bayou.

July 1, 1894, balance unexpended		$610.51
Amount appropriated by act of August 17, 1894		15,000.00
		15,610.51
June 30, 1895, amount expended during fiscal year		1,502.29
July 1, 1895, balance unexpended		14,108.22
July 1, 1895, outstanding liabilities	$290.00	
July 1, 1895, amount covered by uncompleted contracts	13,500.00	
		13,790.00
July 1, 1895, balance available		318.22

Amount (estimated) required for completion of existing project	176,549.75
Amount that can be profitably expended in fiscal year ending June 30, 1897	15,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix T 6.)

7. Harbor at Brazos Santiago, Tex.—In its natural state the channel over this bar was shifting and its depth varied from 6 to 8 feet. The present (original) project for its improvement was adopted in 1881, the object being to fix the position of the channel over the bar at the entrance and to deepen it. The total amount expended to June 30, 1894, was $189,949, besides an appropriation of $6,000 in 1878 applied to removing a wreck. This expenditure has had no useful effect upon the bar, and the works heretofore constructed have practically disappeared.

The amount expended during the fiscal year was $30, and was principally applied to keeping a record of commercial statistics.

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July 1, 1894, balance unexpended	$57,551.00
June 30, 1895, amount expended during fiscal year	30.00
July 1, 1895, balance unexpended	57,521.00
July 1, 1895, outstanding liabilities	15.00
July 1, 1895, balance available	57,506.00

Amount (estimated) required for completion of existing project..... 1,071,090.23
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.

(See Appendix T 7.)

EXAMINATIONS AND SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations and survey of the following localities, required by the act of August 17, 1894, were made by the local engineer, Maj. A. M. Miller, Corps of Engineers, and reports thereon submitted through the division engineer:

1. *Preliminary examination of Colorado River from the mouth to the city of Wharton, Tex.*—Major Miller submitted report of examination December 12, 1894. It is his opinion, concurred in by the division engineer, Colonel Comstock, and by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 141, Fifty-third Congress, third session. (See also Appendix T 8.)

2. *Preliminary examination of Guadalupe River, Texas, from its mouth to the city of Cuero.*—Major Miller submitted report of examination December 13, 1894. In his opinion, concurred in by the division engineer, Colonel Comstock, and by this office, the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 155, Fifty-third Congress, third session. (See also Appendix T 9.)

3. *Preliminary examination of the bar and harbor at Brazos Santiago, Tex.*—Major Miller submitted report of examination December 11, 1894. It is his opinion, concurred in by the division engineer, Colonel Comstock, and by this office, that this harbor at present is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 140, Fifty-third Congress, third session. (See also Appendix T 10.)

4. *Preliminary examination of Brazos River, Texas, from the city of Waco to the town of Richmond.*—Major Miller submitted, under date of February 15, 1895, report of preliminary examination. It is his opinion, concurred in by the division engineer, Colonel Robert, and by this office, that the river between the points named is not worthy of improvement by the General Government. (See Appendix T 11.)

5. *Survey of Brazos River, Texas, from the town of Velasco to the town of Richmond.*—Major Miller submitted report of the results of this survey under date of February 14, 1895. He states that the Brazos between Velasco and Richmond can be improved for navigation at good boating stages by the removal of snags and overhanging trees. It is estimated that for $10,000 this portion of the river can be put in a good navigable condition at ordinary stages, and that an annual expenditure of $2,500 would keep it in this condition. (See Appendix T 12.)

Major Miller was also charged with the duty of making survey for determining the causes of the erosion of the easterly end of Galveston Island, Texas, and estimating the cost of works to prevent the same, the report of the results of which will be duly submitted when received.

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WESTERN RIVERS.

IMPROVEMENT OF CERTAIN RIVERS AND WATERWAYS IN LOUISIANA, TEXAS, ARKANSAS, MISSISSIPPI, AND TENNESSEE TRIBUTARY TO MISSISSIPPI RIVER; WATER GAUGES ON MISSISSIPPI RIVER AND PRINCIPAL TRIBUTARIES.

This district was in the charge of Capt. J. H. Willard, Corps of Engineers; Division Engineers, Col. C. B. Comstock, Corps of Engineers, to February 3, 1895, and Col. H. M. Robert, Corps of Engineers, since February 5, 1895.

1. Red River, Louisiana and Arkansas.—This improvement was begun in 1828 and appropriations aggregating $535,765.50 were made between 1828 and 1852. Between 1841 and 1852 no appropriation was made and a longer interval elapsed between 1852 and 1872, during which the results of former work were lost.

The present improvement commenced in 1872. At that time the river above Shreveport, La., was closed by the great raft 32 miles long and increasing with each flood; below Shreveport navigation was affected seriously by the gradual enlargement of Tones Bayou Outlet, which depleted the main channel of the river and threatened its ultimate closure to navigation; the falls at Alexandria were impassable at low stages and the river was obstructed by snags, sunken logs, wrecks, leaning timber, etc., its entire length.

The project adopted in 1872 contemplated removing the raft and closing Tones Bayou. It has been enlarged since to include snagging operations, etc.; opening and enlarging the channel at Alexandria; closing outlets and constructing and repairing levees and fixing caving banks to confine the river to the adopted channel; to improve and keep navigation open from Fulton, Ark., to head of Atchafalaya River, Louisiana, a distance of 508.6 miles.

The amount expended under this project to June 30, 1894, was $1,131,705.06 with the following results: In the old raft region there flowed in the course marked out for it a broad and deep river, safe at all but the lowest stages, with a channel constantly scouring, the bottom having gone down as much as 15 feet, and the low-water line following it to a certain extent. Tones Bayou Outlet was closing gradually and the main channel below the outlet had widened and scoured until it carried the greater portion of the discharge at flood. The falls at Alexandria were passable the year round. Persistent snagging operations kept the river open, prevented formations of raft, reduced the dangers of navigation to a minimum, and enabled steamboats to make regular trips at low stages. By cooperation with the State of Louisiana and local levee boards a system of levees for restraining floods and confining the river to the adopted channel was well under way, about 114 miles of new levee and enlargement having been undertaken, the proportion of its cost borne by the United States being less than 8 per cent. A thorough survey had been made from Fulton to the Atchafalaya.

During the fiscal year ending June 30, 1895, which was phenomenal for its long-continued period of low water, snagging operations at frequent intervals extended over the river from Fulton to the Atchafalaya with marked benefit to navigation. A line of levee was built from Scopini to Ash Point, in Bossier Parish, La., 13,497 feet in length and containing 261,455 cubic yards of embankment, in carrying out the plan for confining the river to the channel adopted; and in addition to this

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the State of Louisiana and local levee boards constructed 37.3 miles of levees, containing 1,173,867 cubic yards of embankment, at a cost of $142,938.16. A reconnaissance of the river from Sulphur River, Arkansas, to Black River, Louisiana, was made for the purpose of testing and resetting low-water gauges, making local surveys of shoals, and taking discharge observations.

The amounts expended during the year were:

For general improvement	$17,404.20
For Little River from Scopini Cut-off to Knox Point	727.56
For work at Alexandria (survey)	72.80
For survey of Red River	7,850.05
For construction of levees	39,531.64
Total	65,586.25
July 1, 1894, balance unexpended	43,359.69
Amount appropriated by act of August 17, 1894	150,000.00
	193,359.69
June 30, 1895, amount expended during fiscal year	65,586.25
July 1, 1895, balance unexpended	127,773.44
July 1, 1895, outstanding liabilities	148.70
July 1, 1895, balance available	127,624.74
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	150,000.00

(See Appendix U 1.)

2. Red River above Fulton, Ark.—Before work commenced this part of Red River was obstructed by snags and piles of drift, rendering navigation difficult and hazardous at all stages. The project adopted in 1886 contemplated removal of these obstructions to afford reasonably safe navigation at high stages of river to the mouth of Kiamichi River, Indian Territory, about 138 miles above Fulton. Nothing further was recommended, as there was no demand for low-water navigation.

The amount expended to June 30, 1894, was $15,209.64. The project of 1886 was completed in 1891 at a cost of $11,774.89, and at the close of that year it was recommended that no further work be done, unless a single appropriation of $10,000 should be granted, to allow the systematic clearing of the banks and channel without interruption. The two succeeding river and harbor acts appropriated $3,500 each for continuing the improvement, and in 1893 a snag boat was employed for seventy days at a low stage going over the work from Fulton to Kiamichi River; found considerable improvement by scour since the preceding work, and opened a safe low-water channel for its passage, the boat being 36 feet beam and drawing 30 inches.

During the fiscal year ending June 30, 1895, a snag boat thoroughly cleared the stretch of river between Fulton and the Texarkana and Fort Smith Railway bridge, about 23 miles, but was unable to pass above the bridge at the low stage of river. A party in skiffs and bateaux worked above the bridge, removing obstructions in the channel with explosives, until driven out by a rise, which, however, was not sufficient to permit the snag boat to pass the bridge. The distance above Fulton to which work was carried is estimated to be about 65 miles.

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July 1, 1894, balance unexpended	$290.36
Amount appropriated by act of August 17, 1894	3,500.00
	3,790.36
June 30, 1895, amount expended during fiscal year	2,847.03
July 1, 1895, balance unexpended	943.33
July 1, 1895, outstanding liabilities	2.89
July 1, 1895, balance available	940.44
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	3,000.00

(See Appendix U 2.)

3. Cypress Bayou, Texas and Louisiana.—Cypress Bayou evidently was an unnavigable stream until the advance of the Red River raft above Shreveport had converted its bottom lands into reservoirs known as Fairy, Sodo, and Cross lakes. Before the work for its improvement between Shreveport, La., and Jefferson, Tex., commenced, navigation was difficult and dangerous by reason of bars and leaning timber in the bayou proper, and snags, stumps, fallen timber, and sunken logs in the channel through the lakes.

The project adopted in 1872 contemplated straightening the channel and dredging bars in Cypress Bayou, to give uniform depth, and the removal of overhanging trees, shore snags, etc., opening and enlarging the entrance of the bayou into the head of Fairy Lake by dredging, removing stumps, snags, sunken logs, and timber from the channel selected down the lakes, and snags, leaning trees, etc., in Twelve-mile Bayou.

The amount expended to June 30, 1894, was $130,513.59. The original project was completed in 1880 at a cost of $94,000, but owing to the temporary nature of the work it had to be renewed at intervals to maintain what had been accomplished. The last work, for the removal of stumps, snags, and leaning timber, was done in 1893. No dredging has been done since 1888. The removal of the Red River raft and the closure of outlets along the right bank of that stream reduced the water supply and caused the lakes to drain more rapidly, shortening the period of navigation. To determine if navigation could be permanently improved by locks or dams, an extended survey was ordered by Congress, which was completed in 1893 at a cost of $12,000.

The act of August 17, 1894, provided $10,000 for maintenance of the work by dredging, removing obstructions, and straightening the channel, but nothing was done during the fiscal year ending June 30, 1895, there being no plant available, and the long distances a dredge would have to be towed to and from the work rendered advertising for a contract inexpedient with the limited amount available.

July 1, 1894, balance unexpended	$187.74
Amount appropriated by act of August 17, 1894	10,000.00
July 1, 1895, balance unexpended	10,187.74

(See Appendix U 3.)

4. Ouachita and Black rivers, Arkansas and Louisiana.—The improvement of Ouachita River was commenced in 1871. Black River, connecting the Ouachita with Red River, was added under the same head of appropriation by act of 1884. The project under which work has been carried on since 1874 contemplates the removal of snags, logs, wrecks, leaning timber, etc., obstructing navigation, and the improve-

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ment of shoal places by dams and dredging between Camden, Ark., and the mouth of Black River, a distance of 341 miles. No estimate of cost is given, as the nature of the work requires that it be continuous.

The total amount expended to June 30, 1894, was $371,633.99, of which $258,046.12 was applied to operations under the project of 1874. An iron-hull snag boat was purchased in 1875 and repaired with a new steel bottom in 1886, and a small wooden snag boat was purchased in 1888 and rebuilt in 1894. From 1875 to the close of the fiscal year 1894 operations were carried on whenever funds were available and conditions favorable for work, and consisted chiefly of the removal of snags, logs, wrecks, and tree slides in the channel and leaning timber along the banks. An increased depth was gained at some of the shoals by building inexpensive wing dams of stone or brush, the temporary effect of which, however, has been lost of late years. Dredging a safe steamboat channel through the rock and gravel bar at Catahoula Shoals was commenced the latter part of September, 1893, and suspended early in January, 1894, by high stages. During this interval 29,026 cubic yards of material was removed.

In the fiscal year ending June 30, 1895, snagging operations, etc., extended from the mouth of Black River, Louisiana, to Camden, Ark., greatly benefiting navigation by the removal of obstructions in the channel, leaning timber, and tree slides. The stretch above Monroe to Camden was worked over three times, but operations of the snag boat were impeded more or less each trip by rapid rises of the river. Dredging at Catahoula Shoals was resumed July 12 and completed January 25, giving a good channel 225 feet wide and 6 feet deep at low water. During this period 53,492 cubic yards of material was excavated.

The river and harbor act of August 17, 1894, directed that the Secretary of War "submit with his next report on Ouachita River plans and estimates for the improvement of said Ouachita River by locks and dams, to give slack-water navigation as far above its mouth as in his judgment such improvement is practicable, the cost of the same to be paid out of this appropriation." It is practicable to improve the river to its head waters by the method stated in the act, but it is not advisable to prepare plans and estimates for a work of the magnitude without an accurate knowledge of the river and its tributaries, high and low water limits, discharge at extreme stages, and a profile of the bed and banks, which require a survey in advance on an extensive and thorough scale, the cost being estimated at $150,000. If the plan should prove advisable, this sum is small in comparison with the cost of a slack-water system, that will reach into millions under the most favorable conditions, and it is not too much to expend to protect the interest of the United States before entering upon a project for so costly a work.

The act of August 17, 1894, appropriated $50,000 for continuing the improvement of Ouachita and Black rivers, of which sum $30,000 was allotted for beginning the survey. Levels of precision were considered of first importance, and during the fiscal year the line between Red River and Monroe was completed and a second line run from the Coast Survey benches at Little Rock along the railroads to Camden and thence to Frenchport, 13¼ miles by river below Camden, where work was suspended by unfavorable weather, and from which place the levels will be carried to Monroe. The notes of former surveys have been reviewed to obtain all information available and a reconnaissance was made from Camden to Trinity to recover and permanently mark old benches, compare maps of 1873, etc.

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The amounts expended during the year were:

For general improvement	$15,247.87
For Catahoula Shoals	9,932.53
For survey	6,841.38
Total	32,021.78
July 1, 1894, balance unexpended	10,866.01
Amount appropriated by act of August 17, 1894	50,000.00
	60,866.01
June 30, 1895, amount expended during fiscal year	32,021.78
July 1, 1895, balance unexpended	28,844.23
July 1, 1895, outstanding liabilities	11.92
July 1, 1895, balance available	28,832.31
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	50,000.00

(See Appendix U 4.)

5. Bayous D'Arbonne and Corney, Louisiana.—When this work commenced Bayou D'Arbonne was reported navigable six to seven months of the year, but the channel was so much obstructed by snags, stumps, sunken logs, leaning trees, etc., that passage was difficult and dangerous at all stages.

The project adopted in 1884 contemplated removing the obstructions between the mouth of D'Arbonne and Stein Bluff on the Corney Branch, 42½ miles above, to give greater ease and safety to the passage of boats and extend the period of navigation. The cost of thorough work, to be completed in two consecutive seasons, was estimated at $15,000. The act of 1892 required an expenditure of $1,000 in Bayou Corney, above Stein Bluff, and the act of 1894 required that the same amount be expended for removal of obstructions in Little D'Arbonne.

The amount expended during the ten years ending June 30, 1894, was $13,765.45. By the removal of obstructions the period of navigation was increased fully one month; boats of double the capacity of those used formerly were enabled to make quicker time with greater safety; freight rates were reduced one-half, and navigation was extended up the Corney Branch 16½ miles above Stein Bluff.

No work was done during the fiscal year ending June 30, 1895, but it is intended to apply the available funds to the removal of obstructions to navigation of Bayou D'Arbonne and Little D'Arbonne and Corney branches during the season of continued low water this fall.

The work is not permanent, as new obstructions are added from time to time, but as the original project for benefiting high-water navigation has been completed no estimate is made for continuing the improvement.

July 1, 1894, balance unexpended	$1,234.55
Amount appropriated by act of August 17, 1894	3,000.00
	4,234.55
June 30, 1895, amount expended during fiscal year	223.12
July 1, 1895, balance unexpended	4,011.43

(See Appendix U 5.)

6. Bayou Bartholomew, Louisiana and Arkansas.—Before this improvement commenced the bayou was so obstructed by snags, logs, wrecks, leaning timber, etc., that it was navigable for light boats at

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high stages only, or for an average period of about three months in the year.

The project adopted in 1881 contemplated removing these obstructions to render navigation safe and increase the period thereof. The estimate of cost of two consecutive seasons' work was $26,862, but the appropriations made did not permit the thorough work contemplated. Snags and drift are added each year, and at the rate of appropriations in the past, work will have to continue for years to maintain safe navigation at medium and high stages.

The amount expended in the thirteen years ending June 30, 1894, was $36,966.17, resulting in better and safer navigation and increasing the period to about six months of the year, enabling boats of double the capacity of those used formerly to make trips in half the time, and freight rates were reported to have been reduced 50 per cent.

In April, 1895, a snag boat worked over the lower 55 miles of the stream, removing obstructions brought in since October, 1893. The available balance will be applied as soon as practicable to working over this stretch at a low stage, and to continuing operations upstream as far as the funds will permit.

July 1, 1894, balance unexpended	$1,034.07
Amount appropriated by act of August 17, 1894	5,000.00
	6,034.07
June 30, 1895, amount expended during fiscal year	1,144.10
July 1, 1895, balance unexpended	4,889.97
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	5,000.00

(See Appendix U 6.)

7. *Bœuf River, Louisiana.*—This improvement was undertaken by the State of Louisiana more than half a century ago. Before work commenced by the United States the stream was navigable at high stages as far as Point Jefferson, Louisiana, but passage was difficult and dangerous on account of overhanging timber, snags, and logs.

The project adopted in 1881 contemplated removing leaning trees, snags, logs, etc., to give safe navigation at high stages from the mouth to Wallace Landing, about 152 miles above. The closure of three outlets near Point Jefferson, Louisiana, to confine the flow to the main channel, was added to the project in 1886.

The amount expended to June 30, 1894, was $34,795.27, and the work done enabled steamboats to run to Point Jefferson with greater safety, and below the Vicksburg, Shreveport and Pacific Railroad bridge they could safely navigate at any stage high enough to permit them to cross the bars, saving at least thirty-six hours on the round trip. The work is not permanent, as obstructions are added every year. The three outlets near Point Jefferson were closed in 1887–88, as securely as possible with the funds available, and the work gave immediate benefit to navigation by confining the flow to its natural course and scouring the bars below; but the dams were destroyed during the overflow from Mississippi River in the spring of 1890.

During the year ending June 30, 1895, thorough work for the removal of obstructions to navigation extended from Wallace Landing down to Crosby Place, a distance estimated to be about 90 miles. This stretch of river was put in safe condition for navigation, and the work, temporarily suspended by high water, will be continued to the mouth.

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The balance available probably will suffice for maintenance of the improvement to June 30, 1897.

July 1, 1894, balance unexpended	$6,204.73
Amount appropriated by act of August 17, 1894	8,000.00
	14,204.73
June 30, 1895, amount expended during fiscal year	8,498.03
July 1, 1895, balance unexpended	5,706.70
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	8,000.00

(See Appendix U 7.)

8. Tensas River and Bayou Maçon, Louisiana.—The project for improving Tensas River, adopted in 1881, contemplated removing snags, logs, and leaning timber obstructing navigation between the mouth and Dallas, about 134 miles above, at an estimated cost of $23,000. Bayou Maçon, a tributary was added under the same head of appropriation by act of 1884, and the project contemplated the same class of work between its mouth and Floyd, about 98 miles above, at an estimated cost of $17,000. The estimates were based upon calculations for continuous work in one low-water season, and, in view of the appropriations made, are without value, as new obstructions are added every year and require removal in the interest of safe navigation from time to time.

The amount expended to June 30, 1894, was $26,000, of which $9,104.61 was applied to improving Tensas River, and $16,895.39 to Bayou Maçon. With these expenditures, Bayou Maçon below Floyd and Tensas River below the entrance of the Maçon were put in fairly good navigable condition, enabling steamboats to make quicker trips into the Maçon, the principal commercial branch during the navigable season, with comparative ease and safety.

In the past fiscal year Bayou Maçon was worked over from its mouth to Floyd, to remove new obstructions, after which the available balance was applied to work in Tensas River above mouth of the Maçon to Westwood, about 50 miles, putting both streams in good navigable condition for the present so far as operations extended. The amounts expended were $3,257.73 in Bayou Maçon and $1,518.89 in Tensas River.

Amount appropriated by act of August 17, 1894	$5,000.00
June 30, 1895, amount expended during fiscal year	4,776.62
July 1, 1895, balance unexpended	223.38
Amount (estimated) required for completion of existing project	9,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	5,000.00

(See Appendix U 8.)

9. Big Black River, Mississippi.—The project for this improvement, adopted in 1884, contemplated clearing a channel suitable for navigation at high stages by the removal of snags, logs, leaning timber, etc., between the mouth and Cox Ferry, about 130 miles above. The cost of completing the work in two seasons was estimated at $32,000, but new obstructions are added each year.

The amount expended to June 30, 1894, was $10,195.03, which was applied in 1884 and 1891 to removing the chief obstructions to navigation in the lower 70 miles, from Baldwin Ferry to the mouth.

During the fiscal year ending June 30, 1894, the available balance was expended in again working over this stretch, removing a large

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number of obstructions and putting it in fairly good condition for navigation at high stages. On account of caving banks and drift the work will not be permanent.

In view of the small amount of commerce to be benefited, the fact that there is no probability of an increased business for years to come, and the cost of maintaining navigation by the removal of obstructions added every year, no estimate is submitted for continuing this work.

July 1, 1894, balance unexpended	$4,804.97
June 30, 1895, amount expended during fiscal year	4,804.97

(See Appendix U 9.)

10. Yazoo River, Mississippi.—Prior to improvement this stream was obstructed by wrecks of gunboats, steamers, etc., sunk along the channel to prevent navigation during the war of the rebellion, and by snags, sunken logs, leaning timber, etc.

Nine wrecks were removed by contract in 1873–74, and in 1874 a project was submitted to thoroughly clear the river of obstructions in a period of four years, at a cost of $120,000; small annual appropriations to be made thereafter for maintenance. The appropriations made were not sufficient to carry out this project, and the plan under which work has continued contemplates removing wrecks, snags, logs, leaning timber, etc., so far as the funds provided from time to time will permit. Floods, sliding and caving banks, and growing timber add new obstructions, and snagging operations, etc., should continue in the interest of safe navigation.

The amount expended to June 30, 1894, was $232,536.87. The benefits derived from the work were marked. The large number of wrecks which obstructed the river and limited the period of navigation were removed, and the work of snag boats, repeated from time to time, gave steamboat navigation from head to mouth the year round.

During the fiscal year ending June 30, 1895, nothing was done beyond the care and repair of plant, it having been deemed advisable to reserve the available funds for snagging operations, etc., during the period of continued low water this fall.

July 1, 1894, balance unexpended	$2,463.13
Amount appropriated by act of August 17, 1894	20,000.00
	22,463.13
June 30, 1895, amount expended during fiscal year	3,959.19
July 1, 1895, balance unexpended	18,503.94
July 1, 1895, outstanding liabilities	15.05
July 1, 1895, balance available	18,488.89
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	25,000.00

(See Appendix U 10.)

11. Mouth of Yazoo River and harbor at Vicksburg, Miss.—The shifting bar at mouth of Yazoo River is the most serious obstruction to navigation of that river and its main tributaries, a system of about 800 miles. At low stages boats are prevented from entering or leaving the river without lightering, and frequently navigation across the bar is closed entirely. The proposed improvement contemplates making a new outlet from the former mouth of Yazoo, on Old River, through the deep water in Old River, across the neck of low land between Long and Barnett lakes to Lake Centennial, around the head of De Soto Island, and along the front of Vicksburg, entering the Mississippi River on the

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channel side at Kleinston. The cost of the work is estimated at $1,200,000. Vicksburg Harbor is the old channel of the Mississippi in front of that city, extending to the proposed entrance of the new mouth at Kleinston, and comes under the project given above.

The amount expended to June 30, 1894, was $13,915.21, which was applied to surveys, borings, gauging observations, locating a final line for the cut from Old River to Lake Centennial, and completing the maps; and, with the exception of acquiring and clearing and grubbing the lands necessary for right of way, the preliminaries to beginning work were completed.

Operations during the fiscal year ending June 30, 1895, consisted chiefly of clearing and grubbing Vicksburg Harbor to full width, the bar at head of Lake Centennial, and a part of the land between Lake Centennial and Old River. On the latter stretch all the timber was felled and the grubbing is about half done. Discharge observations, slopes and soundings at the present mouth of the river were taken, and Vicksburg Harbor was cross-sectioned to determine changes. With a view to acquiring the right of way from Old River to Lake Centennial, abstracts of all conveyances of record were prepared and submitted to the Attorney-General and his opinion as to validity of titles to same has been given. By an act approved February 2, 1894, the legislature of Mississippi authorized cession of jurisdiction to the United States over lands acquired for canals, etc. June 29, 1895, the Secretary of War authorized the purchase of the lands needed, with exception of a tract in which certain complications connected with the title necessitated resort to condemnation proceedings, and requested the Attorney-General to instruct the district attorney to prepare title papers of the lands to be purchased, and to institute the condemnation proceedings.

The original estimate of cost of this work was $1,500,000, which was revised by the officer in charge in 1893 and the sum total reduced to $1,200,000, upon a basis of continuous work to be finished in three years. If operations are delayed by small and intermittent appropriations, it is probable that the cost may reach or exceed the original estimate.

July 1, 1894, balance unexpended	$61,084.79
Amount appropriated by act of August 17, 1894	265,000.00
	326,084.79
June 30, 1895, amount expended during fiscal year	29,802.56
July 1, 1895, balance unexpended	296,282.23
July 1, 1895, outstanding liabilities	589.99
July 1, 1895, balance available	295,692.24
Amount (estimated) required for completion of existing project	860,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	225,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix U 11.)

12. Tchula Lake, Mississippi.—Before this work was undertaken navigation of the lake was obstructed its entire length by a network of logs lying on the bottom with arms projecting upward, sawyers, heavy leaning timber, and a thick growth of brush along both banks; the latter at places encroaching on the channel until passage of boats was difficult at any stage.

The project adopted in 1881 contemplated removing these obstructions to prolong the period of navigation and permit light-draft boats

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to pass through the lake earlier in the cotton season. The work is of temporary character, as obstructions are adding from time to time.

The amount expended to June 30, 1894, was $15,053.82, with which the greater portion of the leaning timber was cleared and the main obstructions removed from the channel, giving greater ease and safety to passage of steamboats; but the period of navigation was not prolonged, owing to enlargement of bars in the lake.

During the fiscal year ending June 30, 1895, work was carried from foot to head of the lake, and at the close of the year was being carried back to the mouth to remove snags and logs in the channel missed on the trip up.

The expenditure of the balance available will put the stream in safe navigable condition, and further work should not be necessary for several years.

July 1, 1894, balance unexpended	$2,946.18
Amount appropriated by act of August 17, 1894	3,000.00
	5,946.18
June 30, 1895, amount expended during fiscal year	4,322.07
July 1, 1895, balance unexpended	1,624.11
July 1, 1895, outstanding liabilities	9.00
July 1, 1895, balance available	1,615.11

(See Appendix U 12.)

13. Tallahatchee River, Mississippi.—Before this improvement commenced the river was navigable about six months of the year, but passage for steamboats was difficult and dangerous. The project adopted in 1879 contemplated removing snags, sunken logs, wrecks, leaning timber, etc., obstructing navigation between the mouth of the river and its junction with Coldwater River, about 100 miles above.

The amount expended to June 30, 1894, was $42,490.45, of which the appropriation acts required $10,000 to be applied to improvement of the stretch above mouth of the Coldwater to Batesville, a part of the stream in which there has been no navigation since the war. The work done enabled steamboats to run to Sharkey Landing, about 65 miles above the mouth, at all stages the year round. The appropriations were too small to permit much work between Sharkey Landing and Coldwater River. No benefit was derived from the work done in 1880, 1881, and 1882 above mouth of Coldwater River to Batesville.

New obstructions are added every year by sliding and caving banks, and the shifting and scouring of the channel expose others on the bottom or lodges them upon bars.

Operations were not resumed during the fiscal year ending June 30, 1895, but the available funds will be expended for snagging operations during the season of low water this fall.

July 1, 1894, balance unexpended	$9.55
Amount appropriated by act of August 17, 1894	4,000.00
	4,009.55
June 30, 1895, amount expended during fiscal year	365.65
July 1, 1895, balance unexpended	3,643.90
July 1, 1895, outstanding liabilities	6.50
July 1, 1895, balance available	3,637.40
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	1,500.00

(See Appendix U 13.)

14. Steele and Washington bayous, Mississippi.—The improvement of Steele Bayou commenced under the river and harbor act of 1884. Wash-

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ington Bayou, about 7 miles long, which connects Steele Bayou with Lake Washington, was added by act of 1886. The project contemplates removing snags, stumps, drift, and leaning timber obstructing high-water navigation.

The amount expended to June 30, 1894, was $10,056.43, with which Steele Bayou was worked over twice from its source in Swan Lake to its mouth, and the obstructions in Washington Bayou were removed in 1886, resulting in greater ease and safety to steamboat navigation, but the work was by no means thorough, on account of small appropriations.

No work was done during the fiscal year ending June 30, 1895.

Steamboat navigation of this stream was not commenced until 1879, and since the construction of a railroad through the country in 1884 it has dwindled until there is practically no trade. It is navigable only when the Mississippi is high enough to fill the lower part with back-water, and owing to the uncertainty of navigation there is no probability that the steamboat business will revive. In view of the foregoing, no estimate is made for continuing work.

July 1, 1894, balance unexpended	$2,443.26
July 1, 1895, balance unexpended	2,443.26

(See Appendix U 14.)

15. Big Sunflower River, Mississippi.—Before the improvement of this river commenced navigation its entire length was badly obstructed by snags, sunken logs, leaning timber, and sand bars. The low-water channel in many places was so filled with logs as to give no greater depth than 18 inches, and so narrow as to yield passage for the smallest boats only. Leaning timber obstructed navigation at all stages, and Oliphants Bar, extending from the mouth upstream 15 miles, and Muscle Shoals, 5 miles in length, beginning 38 miles above the mouth, had depths at low water ranging from 17 to 24 inches.

The project of 1879 contemplated the expenditure of $66,000 in three to four consecutive seasons of low water for the removal of snags, sunken logs, and leaning timber below Clarksdale and for building wing dams to scour a channel about 40 inches deep at the bars. No estimate was made for maintenance by removing obstructions constantly brought in by sliding banks, etc. The total amount appropriated since March, 1879, is $67,000. The amount expended to June 30, 1894, was $61,343.63, which was applied from time to time, as available, in the endeavor to carry out the project so far as the funds would permit. In 1879 the river was navigable for very light steamers about six months of the year. In 1890 it was navigable the year round, but difficult and dangerous at low stages. Larger boats were used, made the trips in little more than half the time required formerly, and freight rates were reported to be 50 per cent less. Since the fiscal year 1890 the appropriations were scarcely sufficient to maintain what was accomplished the preceding eleven years.

Work was not resumed during the fiscal year ending June 30, 1895, for lack of plant for the purpose.

July 1, 1894, balance unexpended	$656.37
Amount appropriated by act of August 17, 1894	5,000.00
	5,656.37
June 30, 1895, amount expended during fiscal year	689.68
July 1, 1895, balance unexpended	4,966.69
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	1,500.00

(See Appendix U 15.)

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16. Big Hatchee River, Tennessee.—This work commenced in 1880. The project contemplated removing snags, logs, leaning timber, etc., to render the stream as high as Bolivar, about 240 miles above the mouth, navigable for light-draft boats the year round. In 1880 the cost was estimated at $30,000, if the work was completed in three consecutive seasons. New obstructions are adding continually, and no estimate for permanent improvement has been made.

The amount expended to June 30,1894, was $32,244.72, rendering the stream navigable for light boats from seven to nine months of the year. Before work commenced the stream was unnavigable on account of obstructions in the channel and leaning timber.

During the fiscal year ending June 30, 1895, the stream was worked over between Rialto and its mouth, about 60 miles, rendering navigation in that stretch easy and comparatively safe at medium and high stages, that being all that could be accomplished with the means available.

The officer in charge reports that the small amount of commerce to be benefited is not commensurate to the cost of continuing this improvement, which opinion is concurred in by this office.

July 1, 1894, balance unexpended	$3,255.28
June 30, 1895, amount expended during fiscal year	3,255.28

(See Appendix U 16.)

17. Water gauges on the Mississippi River and its principal tributaries.—These gauges were designed to secure information from continuous records, with a view to protecting alluvial lands against overflow, improving navigation, and giving correct reports of the stages of water for the benefit of river men and planters. Their establishment and the maintenance of daily observations were enjoined upon the Secretary of War by joint resolution of Congress, approved February 21, 1871 (Stat. L., vol. 16, p. 598). Section 6 of the river and harbor act of 1888 provided a permanent indefinite appropriation for the purpose of securing uninterrupted gauging.

The amount expended to June 30, 1894, was $103,211.25. The 17 gauges ordered by the resolution of February, 1871, were established the latter part of that year, except the one at Carrollton, La., established in January, 1872. Seven additional gauges have been established and 2 discontinued, and there are now 22 gauges maintained. The service has been improved materially of late years. In 1881 bulletins were erected at the stations on the Mississippi for the purpose of giving passing steamboats the stage of water and indicating whether the river was rising, stationary, or falling. In 1890 they were replaced by larger bulletins and the old ones used for extending the service to the tributaries. Since February 1, 1887, the gauges have been read and bulletins posted twice a day, to secure greater uniformity and accuracy; formerly they were read only once a day. The readings have been published by the Mississippi River Commission to end of the calendar year 1894.

July 1, 1894, balance unexpended	$22.46
Amount allotted for fiscal year ending June 30, 1895	5,500.00
	5,522.46
June 30, 1895, amount expended during fiscal year	5,522.44
July 1, 1895, balance unexpended	.02
Amount allotted for fiscal year ending June 30, 1896	5,500.00
Amount available for fiscal year ending June 30, 1896	5,500.02

(See Appendix U 17.)

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EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations of the following localities, required by the act of August 17, 1894, were made by the local engineer, Capt. J. H. Willard, Corps of Engineers, and reports thereon submitted through the division engineer:

1. Preliminary examination of Bayou Dugdemona, Louisiana.—Captain Willard submitted report of examination January 29, 1895. It is his opinion, concurred in by the division engineer, Colonel Comstock, and by this office, that this bayou is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 301, Fifty-third Congress, third session. (See also Appendix U 18.)

2. Preliminary examination of Bayou Castor, Louisiana.—Captain Willard submitted report of examination January 29, 1895. In his opinion, concurred in by the division engineer, Colonel Comstock, and by this office, this bayou is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 303, Fifty-third Congress, third session. (See also Appendix U 19.)

3. Preliminary examination of Little River, Arkansas, from Fulton to White Cliffs.—Captain Willard submitted report of examination January 29, 1895. It is his opinion, concurred in by the division engineer, Colonel Comstock, and by this office, that the river is not worthy of improvement by the General Government at the present time. The report was transmitted to Congress and printed in House Ex. Doc. No. 290, Fifty-third Congress, third session. (See also Appendix U 20.)

4. Preliminary examination of Bœuf River, Arkansas, above Wallaces Landing.—Captain Willard submitted report of examination February 21, 1895. In his opinion, concurred in by Colonel Robert, the division engineer, and by this office, the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 350, Fifty third Congress, third session. (See also Appendix U 21.)

5. Preliminary examination of Bayou Maçon, Arkansas, above Floyd.—Captain Willard submitted report of examination February 21, 1895. He is of opinion, concurred in by the division engineer, Colonel Robert, and by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 349, Fifty-third Congress, third session. (See also Appendix U 22.)

6. Preliminary examination of Yallabusha River, Mississippi.—Captain Willard submitted report of examination February 23, 1895. It is his opinion, concurred in by the division engineer, Colonel Robert, and by this office, that this river is not worthy of further improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 351, Fifty-third Congress, third session. (See also Appendix U 23.)

7. Preliminary examination of Little River, Louisiana.—Captain Willard submitted report of the results of this examination under date of July 26, 1895. It is his opinion, concurred in by the division engineer, Colonel Robert, and by this office, that the river above Catahoula Lake is not worthy of improvement by the General Government, but that it

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is worthy of improvement from Catahoula Lake to its junction with Black River at Trinity, La., to the extent of removing the chief obstructions in the channel and destroying the wrecks at the mouth. No survey of the river is necessary to the preparation of project and estimate of cost of improvement. (See Appendix U 24.)

8. Preliminary examination of Bogue Phalia, Mississippi, especially at the point known as "The Narrows."—The report of the results of this examination was submitted by Major Williard under date of August 22, 1895. It is his opinion, concurred in by the division engineer, Colonel Robert, and by this office, that Bogue Phalia is not at present worthy of improvement by the General Government. (See Appendix U 25.)

9. Preliminary examination of Bear Creek, Mississippi, from where it empties into the Yazoo, upstream.—The report of the results of this examination was submitted by Major Willard under date of August 22, 1895. It is his opinion, concurred in by the division engineer, Colonel Robert, and by this office, that the creek is not worthy of improvement by the General Government. (See Appendix U 26.)

Major Willard was also charged with the duty of making preliminary examination of *Big Sunflower River, Mississippi*, with a view to its improvement as high as Clarksdale by locks and dams, the report of the results of which will be submitted when received.

IMPROVEMENT OF ARKANSAS RIVER AND OF CERTAIN RIVERS IN ARKANSAS AND MISSOURI.

This district was in the charge of Capt. Carl F. Palfrey, Corps of Engineers, to August 16, 1894, and of Lieut. W. L. Sibert, Corps of Engineers, since that date; Division Engineers, Col. C. B. Comstock, Corps of Engineers, to February 3, 1895, and Col. H. M. Robert, Corps of Engineers, since February 5, 1895.

1. Removing obstructions in Arkansas River, Arkansas and Kansas.—This river was, previous to improvement, seriously obstructed by snags, overhanging timber, reefs, and bars.

The original project under this head was to raise and destroy snags, cut overhanging timber, remove bowlders and reefs by blasting and dredging, and cut out sand bars by temporary wing dams. To this was later added the survey of the river, with the view to permanent improvement.

Since appropriations for permanent improvement were made, blasting, dredging, and dams have been omitted from the project, leaving customary snagging operations only.

On this work had been expended from the first appropriations in 1832 up to June 30, 1894, $851,210.62.

The evidence of pilots and masters is that in the permanent reaches of the river the condition has been materially improved; in the shifting channels the relief is only temporary and the obstructions to navigation are still numerous and dangerous. The best illustration of the condition is the fact that steamboats have to pay 18 per cent per annum for insurance.

The operations of the fiscal year have been confined to the reaches of river between foot of Cut-off and Homestead and between Mud Lake and Little Rock. They have made navigation easier.

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July 1, 1894, balance unexpended		$572.84
Amount appropriated by act of August 17, 1894		20,000.00
		20,572.84
June 30, 1895, amount expended during fiscal year		13,464.91
July 1, 1895, balance unexpended		7,107.93
July 1, 1895, outstanding liabilities	$425.00	
July 1, 1895, amount covered by uncompleted contracts	2,111.99	
		2,536.99
July 1, 1895, balance available		4,570.94
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		20,000.00

(See Appendix V 1.)

2. Arkansas River, Arkansas.—Besides obstructions, such as snags, etc.. the natural channel is shifting and obstructed by sand bars fed by caving banks, and also by reefs of rocks in the upper reaches.

Of the earlier appropriations for removing obstructions, $20,000 was allotted to removal of a bar at Fort Smith. Later appropriations were for works at Fort Smith and Pine Bluff, since adopted as part of the general plans of improvement.

The present project is to remove rock and gravel reefs by blasting and dredging, to contract the channel by dikes or dams, permeable or solid, of such construction as the local conditions require, and to hold the channel so obtained by revetment where necessary, the object being to obtain a channel depth of 6 feet from Little Rock to the mouth and one of 2 feet above Little Rock at low water.

For the works already constructed, adopted in 1888 as part of the general project, there had been appropriated up to 1886 $128,500, which has been applied to those works.

From the appropriations for the general improvement of the river, including allotments therefrom for the above works, there was expended to June 30, 1894, $644,124.07.

Work of the character contemplated in the approved project, in a river like the Arkansas, in general does not produce the full effect hoped for until the work of improvement is continuous over a certain reach of river.

The appropriation for improving Arkansas River being divided into three parts, the work in each part in comparison with that necessary to complete the project in that part has been so small that the availability or adaptability of the stream as a whole for the purposes of navigation had not materially improved up to June 30, 1894.

The work prior to above date was more of a local nature, such as the construction of certain dikes at Dardanelle to remove a bar in front of that place; the protection of the caving bank at Pine Bluff, Ark., saving the city from destruction; the construction of dikes to maintain the channel through the drawspan of bridges at Fort Smith, Van Buren, and Little Rock; and other work the immediate effect of which is purely a local improvement, all of which work, however, will form in time a part of a completed project.

The expenditures for the fiscal year ending June 30, 1895, have been for the following works:

(1) Protection of the caving bank at Red Fork, Ark. This work is nearly completed. The water has been so low during the last fiscal year that the stability of this work has not been thoroughly tested.

(2) For the protection of a certain portion of Great House Bend.

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(3) The completion of two dikes near Crystal Hill.

(4) The construction of a dike and dam at the head of Rectors Island. All of this work is in the reach of river immediately above Little Rock, Ark., and is nearly completed. No surveys have yet been made for the purpose of ascertaining the result.

(5) For the maintenance of the channel through the drawspan of the Arkansas Valley Railroad bridge at Fort Smith. This work is about half completed, and has not yet produced the effect expected.

July 1, 1894, balance unexpended		$15,875.93
Amount appropriated by act of August 17, 1894		250,000.00
Received on account of deposit made by First Lieut. William L. Sibert.		17.71
		265,893.64
Reserved in United States Treasury for freight charges	$18.60	
June 30, 1895, amount expended during fiscal year	100,795.39	
Purchase of 250 cubic yards of riprap stone	212.50	
		101,026.49
July 1, 1895, balance unexpended		164,867.15
July 1, 1895, outstanding liabilities	$10,000.00	
July 1, 1895, amount covered by uncompleted contracts	10,103.70	
		20,103.70
July 1, 1895, balance available		144,763.45
Amount (estimated) required for completion of existing project		2,972,479.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		100,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix V 2.)

3. Fourche Le Fevre River, Arkansas.—This stream was obstructed by snags, drift racks, and overhanging timber, and also by shoals of rock and gravel.

The adopted project was for the usual snagging operations and removal of shoals by blasting and dredging. On this project had been expended up to June 30, 1894, $35,579.96.

A channel to Perryville, navigable for light-draft boats at a stage of the Arkansas River reading 4 feet on the Signal Service gauge at Little Rock, has been secured.

There have been no operations in the field during the fiscal year 1895.

July 1, 1894, balance unexpended	$1,420.04
June 30, 1895, amount expended during fiscal year	388.85
July 1, 1895, balance unexpended	1,031.19
July 1, 1895, outstanding liabilities	10.00
July 1, 1895, balance available	1,021.19

(See Appendix V 3.)

4. Petit Jean River, Arkansas.—This stream was obstructed by snags, drift racks, overhanging timber, and by rocky shoals.

The original project (1886) was for the usual snagging operations to Danville, 45 miles.

Additional project (1888, completed in 1891) was for removal of a portion of ledges at Slaty Crossing and Robinsons Ridge. On this river had been expended up to June 30, 1894, $9,314.34.

Under the project of 1888 a navigable channel was cleared to Rocky Crossing, 20 miles.

During the fiscal year 1894 the clearing was extended to Danville, Ark., completing the original project as regards the present condition, no results of snagging being more than temporary.

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There have been no operations in the field during fiscal year ending June 30, 1895. Snags and overhanging timber are reported as again obstructing navigation below Rocky Crossing Bridge, and it is also reported that snags and drift piles obstruct rafting from points above.

July 1, 1894, balance unexpended	$185.66
June 30, 1895, amount expended during fiscal year	115.00
July 1, 1895, balance unexpended	70.66
July 1, 1895, outstanding liabilities	8.00
July 1, 1895, balance available	62.66

(See Appendix V 4.)

5. White River, Arkansas.—Before improvement this river was seriously obstructed by snags and overhanging timber for its entire length, and by shoals in the upper part of the stream.

The originally adopted and the present project includes the usual snagging operations, blasting and dredging, and the contraction of the channel by wing dams.

Under this project there has been expended from appropriations for this river and for separate reaches of it up to June 30, 1894, $287,955.14.

The expenditure of this money has materially improved the navigation of the stream, especially that part of it expended in removing snags, logs, drifts, etc.

The testimony of the steamboat men is that the construction of the wing dams and dikes has not materially lengthened the navigation season.

The operations of the fiscal year 1895 have been snagging and the commencement of the revetment of a bank at Batesville for the purpose of holding the river in its present channel at and near Batesville, Ark.

The effect of the snagging operations has been to render navigation less dangerous. The effect of the revetment work has not yet developed.

July 1, 1894, balance unexpended		$8,044.86
Amount appropriated by act of August 17, 1894		52,000.00
Received on account of deposit made by First Lieut. William L. Sibert.		8.96
Received on account of sale of 250 cubic yards riprap stone		212.50
Increase because of error, authority October 18, 1894		.56
		60,266.88
June 30, 1895, amount expended during fiscal year	$13,945.12	
Reserved in Treasury for freight charges	19.92	
		13,965.04
July 1, 1895, balance unexpended		46,301.84
July 1, 1895, outstanding liabilities	$4,000.00	
July 1, 1895, amount covered by uncompleted contracts	3,157.37	
		7,157.37
July 1, 1895, balance available		39,144.47

Amount (estimated) required for completion of existing project	36,815.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix V 5.)

6. Cache River, Arkansas.—In its original condition this channel was obstructed by snags, overhanging timber, and shoals. The project provides for the usual snagging operations.

On this work there had been expended up to June 30, 1894, $10,887.99. This expenditure had resulted in obtaining a fair channel to James Ferry, about 78 miles above the mouth.

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No work was done during fiscal year ending June 30, 1895. The portion of the river between Riverside and Gregory Branch Railway bridge is again badly obstructed by drifts and fallen timber. Below this bridge fallen timber narrows the channel to Kalachi. Below Kalachi there is a fair channel at 4-foot stage and over.

July 1, 1894, balance unexpended	$112.01
June 30, 1895, amount expended during fiscal year	12.01
July 1, 1895, balance unexpended	100.00
July 1, 1895, outstanding liabilities	4.00
July 1, 1895, balance available	96.00

(See Appendix V 6.)

7. Black River, Arkansas and Missouri.—Before any improvements were made this river was seriously obstructed by snags, logs, and overhanging timber. In many places it was impassable. At several points the channel conditions were abnormal and the water on the shoals at such places was less than the available depth in the river should have been.

The adopted project is and has been for the usual snagging operations, the closing of chutes by dams, and the construction of wing dams to improve the worst shoals.

On this project had been expended from the separate appropriations made for this river up to June 30, 1894, $74,395.59.

The expenditure of this money has made 3-foot navigation practicable the entire year from the mouth of Black to the mouth of Current, 146 miles; has made navigation easier at medium and high stages of water from the mouth of Current River to Poplar Bluff, Mo., 123 miles.

No work was done on this river during the fiscal year ending June 30, 1895, except some slight repairs to plant and the care of property, and the channel conditions are practically the same as noted above. It is estimated that an annual expenditure of $4,000 will maintain a channel reasonably free from snags for boats of 3 feet draft the entire year from the mouth of Black River to the mouth of Current River, 146 miles.

That portion of Black River from the mouth of Current to Poplar Bluff, Mo., 123 miles, has not been improved for low-water navigation. The snags and logs are numerous, the accumulation of years, and it is estimated that it will cost $400 per mile to thoroughly clean out this part of the river and to confine it in one channel.

July 1, 1894, balance unexpended		$1,104.41
Amount appropriated by act of August 17, 1894		9,500.00
Received on account of deposit made by First Lieut. William L. Sibert		18.88
		10,623 29
June 30, 1895, amount expended during fiscal year		1,503.59
July 1, 1895, balance unexpended		9,119.70
July 1, 1895, outstanding liabilities	$50.00	
July 1, 1895, amount covered by uncompleted contracts	530.54	
		580.54
July 1, 1895, balance available		8,539.16
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		5,000.00

(See Appendix V 7.)

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8. Current River, Arkansas and Missouri.—Between the mouth of Current River and the mouth of Little Black, 32½ miles, the channel was originally obstructed by snags, logs, and overhanging timber. Above the mouth of Little Black gravel shoals also interfered with navigation.

The approved project is to remove logs and snags from channel, to cut and deaden overhanging timber, and to contract the channel at the worst shoals by wing dams.

The appropriations made by the United States in 1872 and 1881 ($7,000) were expended in improving this river.

Prior to June 30, 1894, no work had been done on this river for eleven years, and consequently the channel at that date was seriously obstructed by snags and logs.

During the fiscal year ending June 30, 1895, the river was thoroughly snagged from the mouth to Johnsons Landing, 25 miles. This portion of the river is now in good condition and can be navigated the entire year—night and day—by boats drawing not more than 3½ feet of water. The remainder of the river is still obstructed by snags and logs.

Amount appropriated by act of August 17, 1894		$8,000.00
Received on account of deposit made by First Lieut. William L. Sibert		2.00
		8,002.00
June 30, 1895, amount expended during fiscal year		3,559.89
July 1, 1895, balance unexpended		4,442.11
July 1, 1895, outstanding liabilities	$165.00	
July 1, 1895, amount covered by uncompleted contracts	855.32	
		1,020.32
July 1, 1895, balance available		3,421.79
Amount (estimated) required for completion of existing project		2,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		2,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix V 8.)

9. St. Francis River, Arkansas.—This river was, prior to improvement, obstructed by snags, drift, overhanging timber, and shoals. The adopted project has been for the usual snagging operations.

Under this project there has been expended from the separate appropriations made for this river, up to June 30, 1894, $42,547.59.

This has resulted in amelioration of the difficulties of navigation.

The operations of the fiscal year 1895 consisted in working twice over the reach between Madison and the mouth, and once over the reach from Foot of Lake to Griffy Island.

July 1, 1894, balance unexpended		$452.57
Amount appropriated by act of August 17, 1894		8,000.00
		8,452.57
June 30, 1895, amount expended during fiscal year		3,138.13
July 1, 1895, balance unexpended		5,314.44
July 1, 1895, outstanding liabilities	$921.35	
July 1, 1895, amount covered by uncompleted contracts	856.27	
		1,777.62
July 1, 1895, balance available		3,536.82
Amount that can be profitably expended in fiscal year ending June 30, 1897		5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix V 9.)

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10. St. Francis River, Missouri.—Before improvement this section of river was obstructed by snags and overhanging timber.

The project for its improvement provides for the usual snagging operations.

Under this project there had been expended up to June 30, 1894, $16,318.57. This expenditure had resulted in some relief to navigation.

No field operations except commencing the transfer of hand snag boat *Missouri* from Little Rock, Ark., to this stream have been carried on during the fiscal year.

This river is seriously obstructed by snags, logs, and overhanging timber.

July 1, 1894, balance unexpended		$2,181.43
Amount appropriated by act of August 17, 1894		5,000.00
		7,181.43
June 30, 1895, amount expended during fiscal year		1,114.49
July 1, 1895, balance unexpended		6,066.94
July 1, 1895, outstanding liabilities	$260.00	
July 1, 1895, amount covered by uncompleted contracts	855.30	
		1,115.30
July 1, 1895, balance available		4,951.64

(See Appendix V 10.)

11. Removing sunken vessels or craft obstructing or endangering navigation.—There was on June 3, 1895, allotted from the indefinite appropriation made by section 4 of the act of June 14, 1880, the sum of $300 to pay the expenses of removing the wreck of steamer *Eli* at the steamboat wharf at Little Rock, Ark. The work was in progress at the close of the fiscal year.

(See Appendix V 11.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations of the following localities, required by the act of August 17, 1894, were made by the local engineer, Lieut. William L. Sibert, Corps of Engineers, and reports thereon submitted through the division engineer, Col. H. M. Robert, Corps of Engineers:

1. Preliminary examination of the Cache River to Riverside, Ark., with a view to low-water navigation.—The report of the results of this examination was submitted by Lieutenant Sibert, July 25, 1895. It is his opinion, concurred in by the division engineer, Colonel Robert, and by this office, that the river is worthy of improvement to the extent of clearing the channel of snags, etc., from the mouth to James Ferry, a distance of 79 miles.

No survey is necessary to preparation of project and estimate of cost of improvement proposed. (See Appendix V 12.)

2. Preliminary examination of St. Francis River, from the Sunk Lands to Greenville, Mo.—The report of Lieutenant Sibert upon this examination was submitted under date of July 27, 1895. It is his opinion, concurred in by Colonel Robert, the division engineer, and by this office, that the St. Francis River above the Sunk Lands is worthy of improvement by the General Government to the extent of clearing the channel of snags, etc., as far as Poplin, Mo.

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No survey is necessary to preparation of plan and estimate of cost of improvement proposed. (See Appendix V 13.)

Lieutenant Sibert was also charged with the duty of making preliminary examination of *Upper White River, Arkansas*, to determine the proper method of improvement, and report of the results of this examination will be duly submitted when received.

REMOVING SNAGS AND WRECKS FROM MISSISSIPPI RIVER, IMPROVEMENT OF MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS, OF HARBOR AT ST. LOUIS, MO., AND OF KASKASKIA RIVER, ILLINOIS.

This district was in the charge Maj. Charles J. Allen, Corps of Engineers, with Lieut. Chester Harding, Corps of Engineers, under his immediate orders; Division Engineers, Col. C. B. Comstock, Corps of Engineers, to February 3, 1895, and Col. H. M. Robert, Corps of Engineers, since February 5, 1895.

1. Removing snags and wrecks from Mississippi River.—Before this work was inaugurated the navigation of the river was very much interfered with by numerous snags, logs, etc., which had lodged in the channel, and to which a new accession was brought down on each rise of the river, thus constantly adding new and unknown obstructions to those already there. A large number of wrecks, dangerous to navigation, also occupied the channel.

For the removal of these obstructions appropriations were made as early as 1824, and the project adopted consisted in building boats suitable for removing the snags, etc., and operating them whenever the stage of water was favorable for the work and funds were available.

The total amount expended for this purpose can not be definitely given, as, previous to the appropriation made by act of March 3, 1879, a general amount was appropriated to be applied to several streams as their needs required. From March 3, 1879, when the first specific appropriation was made, up to June 30, 1894, $1,019,010.46 had been expended for this purpose. This expenditure materially improved the navigation of the river and lessened the danger to boats. During the fiscal year ending June 30, 1895, the sum of $78,270.52 was expended upon the improvement. Two snag boats were employed in removing the obstructions to navigation between the mouth of the Missouri River and Bayou Sara, La.

The boats worked a total of 16½ months, removing 3,307 snags, cutting down 17,520 trees, removing 22 drift piles and 3 wrecks, traveling a total distance of 16,402 miles.

The work accomplished during the year has been of great benefit to navigation and commerce. Formerly the wrecking of steamboats from running against snags was of frequent occurrence, but since the snag boats have been regularly at work it is unusual to hear of a boat being sunk by a snag.

One of the snag boats, the *H. G. Wright*, was docked in April last, in order that her hull might be replated. The work of replating is expected to be completed by August 1, next.

An annual appropriation not to exceed $100,000, for carrying on this work, was made by the act of August 11, 1888. Under this appropriation the two snag boats will patrol the river and remove obstructions whenever necessary for them to do so.

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Amount drawn under section 7, act of August 11, 1888		$100,000.00
June 30, 1895, amount expended during fiscal year	$78,270.52	
June 30, 1895, outstanding liabilities	4,054.45	
June 30, 1895, amount covered by uncompleted contracts	*17,675.03	
		100,000.00
July 1, 1895, amount available for fiscal year 1895–96		100,000.00

(See Appendix W 1.)

2. Mississippi River between Ohio and Missouri Rivers.—The original condition of the navigable channel of this portion of the Mississippi River before the work of improvement was begun was such that the natural depth at low water was in many places from 3½ to 4 feet. The channels were divided by islands which formed sloughs and secondary channels, through which a good deal of the volume of the flow was diverted to the detriment of navigation.

The first work for improvement began in 1872 and was continued for a number of years as appropriations were made, the works consisting of dikes and dams of brush and stone, erected with a view to confining the low-water volume to a single channel, and of revetments to hold and preserve the banks where necessary or advisable to do so.

The present project is a continuation of the plan adopted in 1881. It also contemplates confining the volume of the river at low water to a single channel, its approximate width to be, below St. Louis, about 2,500 feet, the natural width being in many cases from 1 to 1½ miles. The method principally employed is the closing of sloughs and secondary channels and building up of new banks, out to the lines desired, from the solid matter brought down by the river and which is collected by means of hurdlework. The banks, both new and old, are revetted where necessary.

The object of the improvement is to eventually obtain a minimum depth, at standard low water, of 6 feet from the mouth of the Missouri to St. Louis, and of 8 feet from St. Louis to the mouth of the Ohio.

The original estimate of the cost of the improvement, as revised in 1883, is $16,397,500.

The total amount expended to June 30, inclusive, 1894, was $5,190,490.18. It resulted in extending the improvement to Fort Chartres Landing, about 40 miles below St. Louis, and in giving a least depth of 6 feet in the channel at low water.

Amount expended during the past fiscal year, $382,204.74, which resulted in extending the work to Stantons Landing at Ste. Genevieve, 48 miles below St. Louis, with a least depth over the entire distance of 6 feet.

The depths here given are with reference to the plane of standard low water, which is 4 feet above the zero of the gauge at St. Louis.

The work projected for the distance above given is not entirely completed. There are gaps to be filled as soon as the stage of water permits of resuming work at unfinished points.

The total of construction work done during the year is as follows:

	Linear feet.
Hurdles built	19,530
Hurdles added to and repaired	550
Bank protection (revetment), including extensions and repairs	10,566

Of the works constructed to date it must be said that they have been of great benefit to navigation.

* The contract for replating the U. S. snag boat *H. G. Wright*, amounting to $22,900, will be paid partly from this year's appropriation and partly from the appropriation for fiscal year 1895–96.

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The sum asked for the fiscal year ending June 30, 1897, is to be applied to continuance of work under the present project.

July 1, 1894, balance unexpended		$197,843.15
Amount appropriated by sundry civil act approved August 18, 1894		758,333.33
Amount appropriated by sundry civil act approved March 2, 1895		758,333.33
		1,714,509.81
June 30, 1895, amount expended during fiscal year		382,204.74
July 1, 1895, balance unexpended		1,332,305.07
July 1, 1895, outstanding liabilities	$126,505.79	
July 1, 1895, amount covered by uncompleted contracts	155,780.55	
		282,286.34
July 1, 1895, balance available		*1,050,018.73
Amount (estimated) required for completion of existing project		9,492,500.01
Amount that can be profitably expended in fiscal year ending June 30, 1897		433,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix W 2.)

3. Harbor at St. Louis, Mo.—St. Louis Harbor is about 18 miles long and divided into two nearly equal parts by the Eads Bridge. The upper part, included between the bridge and the northern limits of the city, is about 10 miles in length.

Three miles above the Eads Bridge is the Merchants Bridge. The lower part of the harbor, included between Eads Bridge and River Des Peres, is 8 miles long. The channel in this part of the harbor has sufficient depth and accessible landings at all points. Good depth exists above the Merchants Bridge.

Congress, by act approved September 19, 1890, appropriated $182,000 for improvement of this harbor.

The navigable reach between the Eads Bridge and Merchants Bridge was at that time obstructed by a number of middle bars. The project adopted for improvement of the harbor under the appropriation of 1890 consisted in a contraction of the waterway between those bridges to a width of about 2,000 feet, in order to concentrate the flow upon the bars and thus cause scour to the depth desired. The contraction works consisted of a series of hurdles extending out from the Illinois shore, the object of the hurdles being to collect deposits of material brought down during floods, and thus build up a new bank to the line desired.

This work, which was accomplished by the close of the fiscal year ending June 30, 1892, caused extensive deposits of sediment along the line of hurdles, and has resulted in considerable increase in channel depth, with corresponding benefit to navigation.

Amount expended to July 1, 1894, $150,762.03.

Soundings made in December, 1893, when the river stood at zero of the gauge, showed a navigable depth of 11 feet in the improved channel.

There was no expenditure during the past fiscal year.

Soundings taken April 20, 1895, ranged from 12 to 24 feet in depth with the river at a 7-foot stage.

The deposit from action of the hurdles is still increasing and is described in the full report of the officer in charge.

* Of this amount, $1,018,918.73 is at present available for works in progress, $31,100 being allotted for special work at Cape Girardeau and Cairo. The $8,746.74 remaining from the allotment of $50,000 for work at Ste. Genevieve, made in the act of September 19, 1890, was expended during the past fiscal year in repairs to and extension of the work opposite Ste. Genevieve Landing at Little Rock, and which was begun in 1891.

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The full amount of the estimate for improvement of this part of the harbor has been appropriated. With the balance remaining it is proposed to repair damage that may occur to the hurdles from ice and drift and to extend them wherever found necessary to do so.

July 1, 1894, balance unexpended	$31,237.97
July 1, 1895, balance unexpended	31,237.97
July 1, 1895, outstanding liabilities	230.04
July 1, 1895, balance available	31,007.93

(See Appendix W 3.)

4. Kaskaskia River, Illinois.—The original condition of this river was such that navigation at low water was at times almost entirely suspended by reason of snags, shoals, and bars, the navigation being influenced, as to its duration, by the stage of water in the Mississippi River. The least depth found in the Kaskaskia, when the St. Louis gauge read 6.5 feet, was 9 inches over what is called the "Nine-Mile Shoal," 6 miles above the river mouth. At high water, navigation was possible as far up as New Athens.

The first appropriation for this improvement was $6,000, made by act of Congress September 19, 1890, and the approved project consisted in excavation of a channel through the shoals so as to afford a low-water navigation of 36 inches of depth, and in the removal of snags and obstructions from the channel. A further appropriation of $4,500 was made by the act of July 13, 1892.

The original estimate of cost of the project was $10,500.

The amount expended upon the improvement to the close of the fiscal year ended June 30, 1894, was $10,460.80. The result of the expenditure was the excavation of a channel 75 feet wide and 36 inches deep, at low water, at Nine-Mile Shoal, and of a channel 60 feet wide and 34 inches deep at Evansville Shoal, the excavated rock having been utilized in constructing dikes to concentrate the flow of water in the cuts. The rock was excavated largely by blasting. A large number of snags, trees, rack heaps, and logs, and also several rocks, were removed from the stream between Baldwin Bridge and Cox's Ferry. The work greatly benefited the commerce of the river by giving a longer period of low-water navigation than had formerly obtained.

No work was done during the fiscal year ended June 30, 1895, the small balance ($39.20) available not being sufficient for undertaking any.

The full amount of the original estimate having been appropriated, no further appropriation is here asked for.

July 1, 1894, balance unexpended	$39.20
July 1, 1895, balance unexpended	39.20

(See Appendix W 4.)

IMPROVEMENT OF MISSISSIPPI RIVER BETWEEN MOUTH OF MISSOURI RIVER AND MINNEAPOLIS, AND OF GALENA RIVER, ILLINOIS.

This district was in the charge of Lieut. Col. Alexander Mackenzie, Corps of Engineers, to June 5, 1895, having under his immediate orders Lieut. William V. Judson, Corps of Engineers, to November 15, 1894, and Lieut. Charles Keller, Corps of Engineers, since July 18, 1894; and in the temporary charge of Lieutenant Keller since June 5, 1895; Division Engineer, Col. O. M. Poe, Corps of Engineers, to April 3, 1895.

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1. Operating snag boats and dredge boats on Upper Mississippi River.—At the beginning of the fiscal year there was available, under act of August 11, 1888, the sum of $25,000.

From April 2 to October 29, 1894, and from May 15 to June 30, 1895, the snag boat *General Barnard* was employed removing snags and other obstructions and otherwise assisting interests of navigation between Minneapolis and the mouth of the Missouri River.

The snag boat *J. G. Parke* served as tender to dredge *Vulcan* in removing wrecks and deepening channels from July 19 to September 4, 1894. During remainder of that season, and in June, 1895, she was employed on construction work between Illinois and Missouri rivers.

The total amount expended for snag-boat service on the Upper Mississippi River between Minneapolis and the mouth of the Missouri River to June 30, 1894, is $674,640.

By the river and harbor act of August 11, 1888, provision was made for operating snag boats and dredge boats on the Upper Mississippi River under a permanent appropriation, the sum so expended not to exceed $25,000 annually.

The total amount of freight transported on the Upper Mississippi River during the calender year 1894 was, approximately, 2,975,000 tons.

The amount expended during fiscal year ending June 30, 1895, was $25,000.

(See Appendix X 1.)

2. Mississippi River between Missouri River and Minneapolis.—At the beginning of the fiscal year there was available for improvement work between the limits mentioned, under acts of September 19, 1890, and March 3, 1893, the sum of $140,934.21, to which was added by act of August 18, 1894, $866,666.67, making a total of $1,007,600.88. Under this head is carried on the improvement of through navigation.

Work has been in progress under approved projects since 1878, and very favorable results have been secured, showing that with a continuance of the work under liberal appropriations the low-water channel of the Mississippi River between St. Paul and the Missouri River can be made comparatively deep, available, and permanent. The interests for which the improvement is being made are very large and important. The amount of freight carried during 1894, including the logs and lumber floated in the river, aggregated, approximately, 2,975,000 tons.

The original condition of the channel between the Missouri River and St. Paul was such that in low stages the larger boats were unable to proceed farther up the river than La Crosse or Winona, and in many seasons at points much lower down their progress was checked or seriously hindered. In all such cases through freight was reshipped on small and light-draft boats or barges. The originally adopted project for the improvement, which has not been materially changed, proposed the contraction of the channel or waterway by means of wing and closing dams to such an extent as, by means of the scour thereby caused, to afford a channel of sufficient width and of a depth of 4.5 feet at low water, to be eventually increased to 6 feet by further contraction.

There was expended on the permanent improvement of through navigation to June 30, 1894, the sum of $4,985,155.16, or $6,885.57 per mile. At that date and for several years previous the condition of the channel was such as to permit the passage of the largest boats at very low stages through to St. Paul.

During the past year work has been carried on by hired labor and use of Government plant, materials being purchased by competition,

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between St. Paul and Lake Pepin; between Reeds Landing and Genoa; at Rock Island Rapids; between Keithsburg and Nashville; between Quincy and Clarksville, and between the Illinois and Missouri rivers; and by contract between Smiths Bar and Lake Pepin; between Genoa and Prairie du Chien; between Dubuque and Clinton; between Muscatine and New Boston; between Quincy and Hannibal; between Clarksville and Hamburg; between Hamburg and Cap au Gris, and between Cap au Gris and the Illinois River. The work of the year has resulted in satisfactory improvement at all localities.

July 1, 1894, balance unexpended		$293,459.42
Amount appropriated by sundry civil act approved August 18, 1894		866,666.67
Amount appropriated by sundry civil act approved March 2, 1895		866,666.67
		2,026,792.76
June 30, 1895, amount expended during fiscal year		872,684.38
July 1, 1895, balance unexpended		1,154,108.38
July 1, 1895, outstanding liabilities	$63,868.02	
July 1, 1895, amount covered by uncompleted contracts	312,489.72	
		376,357.74
July 1, 1895, balance available		777,750.64
Amount that can be profitably expended in fiscal year ending June 30, 1897. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		567,000.00

(See Appendix X 2.)

3. Operating and care of Des Moines Rapids Canal and Dry Dock.—During the past year the Des Moines Rapids Canal was open for navigation 251 days, during which time there passed through it 606 steamboats and 340 barges, carrying 14,141 passengers, 22,034.5 tons of merchandise, and 55,729 bushels of grain. There also passed through the canal 155,625,800 feet, B. M., of lumber, 29,545,910 feet of logs, 55,670,204 shingles, and 55,064,938 laths.

The dry dock was in constant use during the whole year.

The cost of operating and care of the canal is provided for by an indefinite appropriation made by act of March 3, 1881.

The amount expended during the year was $41,052.80.

(See Appendix X 3.)

4. Operating and care of Galena River improvement, Illinois.—This improvement, consisting of a lock and dam in the Galena River, was purchased by the United States in March, 1894, under provisions of act of Congress of September 19, 1890, at a cost of $100,000. During the past year the lock was open for navigation 230 days, during which time there passed through 471 steamboats and barges, carrying 4,798 passengers and 1,939 tons of merchandise.

The cost of operating and care of the canal is provided for under an indefinite appropriation made by act of Congress approved July 5, 1884.

The amount expended during the year was $6,000.

(See Appendix X 4.)

5. Mississippi River between Minneapolis and St. Paul; construction of Lock and Dam No. 2.—By river and harbor act of August 17, 1894, authority was given for commencement of improvement by slack-water navigation. During the year surveys were made for locating Lock and Dam No. 2, and steps were taken for acquiring the needed land. The

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money available being insufficient to build the lock foundation, no construction work was performed.

Amount appropriated by river and harbor act of July 13, 1892 (allotment)	$49,877.67
Amount appropriated by river and harbor act of August 17, 1894	51,000.00
	100,877.67
June 30, 1895, amount expended during fiscal year	2,441.04
July 1, 1895, balance unexpended	98,436.63
Amount (estimated) required for completion of existing project	499,798.37
Amount that can be profitably expended in fiscal year ending June 30, 1897	25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix X 5.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations and surveys of the following localities, required by the act of August 17, 1894, were made by the local engineer, Lieut. Col. Alexander Mackenzie, Corps of Engineers, and reports thereon submitted:

1. Preliminary examination of Quincy Bay, Illinois.—Lieutenant-Colonel Mackenzie submitted report of examination October 26, 1894. From the facts and reasons given, he reports that it is evident that Quincy Bay is worthy of improvement by the General Government, and his views are concurred in by the division engineer, Col. O. M. Poe, Corps of Engineers, and by this office. The necessary survey to furnish data for future work can be made with funds available. The report was transmitted to Congress and printed in House Ex. Doc. No. 52, Fifty-third Congress, third session. (See also Appendix X 6.)

2. Preliminary examination of La Crosse Harbor, Wisconsin.—Lieutenant-Colonel Mackenzie submitted report of examination September 21, 1894. It is his opinion, concurred in by the division engineer and by this office, that this harbor is worthy of improvement by the General Government, if such improvement can be given at a cost commensurate with the interests involved. It is estimated that the survey necessary for preparation of plan and estimate for improvement will cost $500. The report was transmitted to Congress and printed in House Ex. Doc. No. 78, Fifty-third Congress, third session. (See also Appendix X 7.)

3. Survey of east bank of Mississippi River from the city of Warsaw to the city of Quincy, Ill.—Lieutenant-Colonel Mackenzie submitted report of survey December 8, 1894. He estimates the cost of constructing the proposed levees, "with a view to improving the navigation by preventing the water from overflowing the natural and artificial banks along that part of the river, and deepening the channel," at $85,500. The report was transmitted to Congress and printed in House Ex. Doc. No. 111, Fifty-third Congress, third session. (See also Appendix X 8.)

4. Survey of west bank of the Mississippi River from Flint Creek to the Iowa River.—Lieutenant-Colonel Mackenzie submitted report of survey December 14, 1894. He estimates that an artificial bank to prevent overflow of west bank of Mississippi River from Flint Creek to the Iowa River will cost $305,000. The report was transmitted to Congress and printed in House Ex. Doc. No. 161, Fifty-third Congress, third session. (See also Appendix X 9.)

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IMPROVEMENT OF MISSISSIPPI RIVER ABOVE FALLS OF ST. ANTHONY, MINNESOTA; OF RIVERS IN WISCONSIN AND MINNESOTA TRIBUTARY TO MISSISSIPPI RIVER, AND OF RED RIVER OF THE NORTH, MINNESOTA AND NORTH DAKOTA; GAUGING MISSISSIPPI RIVER AT ST. PAUL.

This district was in the charge of Maj. W. A. Jones, Corps of Engineers, to June 11, 1895, and in the temporary charge of Capt. H. F. Hodges, Corps of Engineers, since that date; Division Engineer, Col. O. M. Poe, Corps of Engineers.

1. Mississippi River above Falls of St. Anthony, Minnesota.—The project was adopted in 1875. The river was divided into three sections. First section, Falls of St. Anthony to St. Cloud, 78 miles; improvement to be by wing dams and dredging; estimated cost, $144,667.50. Second section, St. Cloud to Conradi Shoal, 42 miles; improvement to be by wing dams, removal of bowlders, and four locks and dams; estimated cost, $1,957,785.75. Third section, Conradi Shoals to Grand Rapids, 217 miles, improvement to be dredging, removal of bowlders, and wing dams; estimated cost, $54,127.50. Total, $2,156,578.75. In 1889, the estimate for improving the upper 130 miles of the third section was placed at $63,000.

The first two appropriations (those of 1874 and 1876), aggregating $45,000, were expended upon the first section, but steamboat navigation having been discontinued over that reach, the third appropriation was applied to the upper 130 miles (Aitkin to Grand Rapids) of the third section, as were also the appropriations of 1881, 1882, and 1888. In 1890 Congress appropriated $18,000 for the completion of the improvement between Aitkin and Grand Rapids, as recommended in the Annual Report of 1889. This amount was expended and accomplished the desired object, and also extended the improved channel from Aitkin to Brainerd, 55 miles. Before improvement the stream between Aitkin and Grand Rapids was so obstructed that navigation was difficult and at times almost impossible for steamers of lightest draft.

Total expenditures to June 30, 1894, including outstanding liabilities, were $45,000 on first section and $63,000 on upper 180 miles of third section. There is now a general depth of 3 feet at low water in the channel above Brainerd. This result, although not the 5 feet called for in the project, is sufficient for all present navigation requirements. In dry seasons the three completed reservoirs at head waters of Mississippi River may be relied upon to furnish sufficient water and depth for boats above Brainerd.

There being no demand at present for navigation between the Falls of St. Anthony and Brainerd, no further appropriation is now asked for. The opening, during the winter of 1889–90, of the Duluth and Winnipeg Railroad from Duluth to the Mississippi River has resulted in a decrease of steamboat traffic. But one steamboat now runs on the river, and she is not operated regularly.

July 1, 1894, balance unexpended	$7.40
June 30, 1895, amount expended during fiscal year	7.40

(See Appendix Y 1.)

2. Construction of reservoirs at head waters of Mississippi River.—The object of the reservoirs is to collect surplus water, principally from the precipitation of winter, spring, and early summer, to be systematically released so as to benefit navigation on the Mississippi River below the dams.

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The reservoir project is the outcome of surveys and examinations made in 1869, 1874, 1878, and 1879. From the results of these examinations and further examinations made in 1880 the first cost of constructing reservoir dams in Minnesota and Wisconsin was placed at $1,809,083. The cost of land and other damages to result from construction and operation of the proposed dams was not included in that estimate, as they could not be predicted with any approach to accuracy.

The present project consists in constructing reservoir dams at head waters of the Mississippi River in Minnesota, that locality having been selected for commencing the work in consequence of an appropriation made by the river and harbor act approved June 14, 1880, for construction of a reservoir dam at Lake Winnibigoshish, Minnesota, and for other reasons given in Appendix Y to the Annual Report for 1886. By 1886 four of the reservoirs had been created. In the spring of 1891 the construction of a fifth reservoir at Sandy Lake was commenced, and one-half was built by fall, 1892, but its completion has been delayed by the provision in the river and harbor act of Congress, July 13, 1892, providing for a navigable pass in the dam. Plans embodying the modifications were drawn and submitted to a Board of Engineers for examination and report. The Board approved the plans, with one modification, and the work is now in progress.

The total expenditures on this work to the close of the fiscal year ending June 30, 1894, including examinations at proposed dam sites, land damages, amounts paid to commissioners in attempted settlements of awards to Indians, and care and maintenance of the works, were $771,093.67.

During the past year the operations have been: Continuing construction of Sandy Lake Dam, making survey for a proposed reservoir at Gull Lake and tributary waters, Cass and Crow Wing counties, Minn., and in operating and maintaining the completed reservoirs to February 1, 1895. Since the latter date the expense of the care and maintenance of the completed reservoirs has been paid out of the appropriation for "Operating and care of canals and other works of navigation, indefinite," and forms the subject of a separate report.

July 1, 1894, balance unexpended	$5,272.58
Amount appropriated by act of August 17, 1894	51,000.00
	56,272.58
June 30, 1895, amount expended during fiscal year	37,898.97
July 1, 1895, balance unexpended	18,373.61
July 1, 1895, outstanding liabilities	2,366.13
July 1, 1895, balance available	16,007.48
Amount (estimated) required for completion of existing project	983,583.50
Amount that can be profitably expended in fiscal year ending June 30, 1897	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix Y 2.)

3. Operating and care of reservoirs at head waters of Mississippi River.—The river and harbor act of August 17, 1894, made applicable to the reservoirs at head waters of the Mississippi River, "so far as concerns their care, preservation, and maintenance," the provisions of the general appropriation for "operating and care of canals and other works of navigation, indefinite," contained in section 4 of the river and harbor act of July 5, 1884.

January 25, 1895, an allotment of $17,590 was made, from which the expenses since February 1, 1895, have been paid.

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There are four completed reservoirs, viz:

At Lake Winnibigoshish, completed in 1883–84; height of dam, 14 feet; capacity, 45,800,000,000 cubic feet.

At Leech Lake, completed in 1884; height of dam, 6 feet; capacity, 30,000,000,000 cubic feet.

At Pokegama Falls, completed in 1884; height of dam, 7 feet, increased in 1889 to 9 feet; capacity, 4,700,000,000 cubic feet.

At Pine River, completed in 1886; height of dam, 17 feet; capacity, 7,500,000,000 cubic feet.

A fifth reservoir at Sandy Lake is in process of construction and nearly completed.

The object of the reservoirs is to collect the surplus water during periods of high and freshet stages and afterwards release it during low-water stages for the benefit of navigation upon the Mississippi River from the dams down to Lake Pepin.

During the past year the reservoirs were operated with the usual advantage to the Upper Mississippi River interests.

Repairs were made to the gates and machinery at Lake Winnibigoshish and Pine River dams. The Pokegama Falls Dam was redecked. (See Appendix Y 3.)

4. Chippewa River, including Yellow Banks, Wisconsin.—The plan for improvement of the Chippewa River consists in revetment of caving bends and construction of dams and jetties from Eau Claire to the confluence of the Chippewa and Mississippi, a distance of 57 miles, to confine the low-water volume to a channel of nearly uniform width and depth. The general plan was adopted in 1877, and the work has been carried on in accordance with it, varying, however, more or less as to location and extent of dams, jetties, etc. The protection of the Yellow Banks consists in a revetment of piling and fascines, the latter to be crowned with rock. The object of the Yellow Banks protection is to prevent their erosion and thus relieve the channel of the Chippewa River and of the Mississippi below the junction of the two streams from the masses of sand contributed by those banks. The plan for protecting the banks was adopted in 1883. The improvement of the river and the protection of the Yellow Banks were regarded as separate and distinct works until the act of August 11, 1888. The original estimate of cost as made in 1875 was $139,892.50. The last revision of the estimate, made in 1888, placed the cost at $272,487.72.

Before the improvement commenced the depth on the bars at low water seldom exceeded 18 inches, and the crossing at the mouth of the river was extremely difficult at that stage, owing to the volume of the river joining the Mississippi through a number of channels of insufficient depth. These latter-named channels were contracted into one of good depth by means of long parallel jetties. Generally, wherever works of improvement were constructed by the Government, the low-water depths were increased from 18 inches to 3 or 4 feet, and the general improvement not only greatly facilitated the passage of steamers and rafts, but also greatly reduced the expense of rafting manufactured lumber. Localities remaining to be improved have a least depth in the channel of about 2 feet.

No work except slight repair has been done at the Yellow Banks since 1883, when 4,978 linear feet of bank revetment had been completed, and the piling for 3,275 feet had been driven ready for the backing of brush and stone.

The total expenditures from the commencement of operations in 1877 to June 30, 1894, including outstanding liabilities, were $171,750.

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During the past year one closing dam was built at Plum Creek and repairs were made to the Plum Island Flats dams.

July 1, 1894, balance unexpended	$49.74
Amount appropriated by act of August 17, 1894	10,000.00
	10,049.74
June 30, 1895, amount expended during fiscal year	3,087.51
July 1, 1895, balance unexpended	6,962.23
July 1, 1895, outstanding liabilities	362.62
July 1, 1895, balance available	6,599.61
Amount (estimated) required for completion of existing project	90,737.72
Amount that can be profitably expended in fiscal year ending June 30, 1897	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix Y 4.)

5. *St. Croix River, Wisconsin and Minnesota.*—The original project and original estimate for this improvement were based upon a survey made in 1874, when the river was at a high stage of water and but comparatively few obstructions to be seen. It contemplated removal of snags, bowlders, sand bars, etc., and contraction of low-water channels from Taylor Falls to the confluence of the river with the Mississippi into one of nearly uniform width. Estimated cost, $21,758. At low water, however, the channel had in many places but 2 feet depth, and steamers and barges made their way as best they could among the obstructions; at times it was impossible for them to get over the shoal places. Following a low-water survey made in 1879, the estimate was revised in 1880, 1882, and 1889. The last aggregated $129,700.

The total expenditures to June 30, 1893, including outstanding liabilities, was $106,012.21.

The work of improvement has been to secure a least depth of 3 feet on the improved bars above Stillwater and 4 to 5 feet on the bars below that place. Generally, it may be said of this improvement that at many points navigation has been rendered permanent where formerly it was uncertain, and that in other places it has been made practicable where before improvement it was impossible.

In the improved parts of the river above Stillwater there is a low-water depth in the channel of 2 feet; below Stillwater there is a good channel with a least depth of 4 feet.

The work of improvement during the last year has consisted in dredging in the channel over Hudson Bar. The work at Hudson enabled the raft boats with their large tows to more easily make the run over the bar.

July 1, 1894, balance unexpended	$5.59
Amount appropriated by act of August 17, 1894	4,000.00
	4,005.59
June 30, 1895, amount expended during fiscal year	620.89
July 1, 1895, balance unexpended	3,384.70
July 1, 1895, outstanding liabilities	1,951.13
July 1, 1895, balance available	1,433.57
Amount (estimated) required for completion of existing project	14,200.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	4,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix Y 5.)

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6. Minnesota River, Minnesota.—From 1867 to 1873 Congress appropriated $77,500 for improving the Minnesota River. The appropriations were applied to removing snags and bowlders, so as to afford a least depth at low-water stage of 2 to 3 feet. In 1874 a survey was made from the mouth of the river to South Bend, a distance of about 116 miles, to determine the practicability of improving the navigation by means of canals, locks, and dams. Based upon this survey, estimates were made for five locks and dams, and removal of snags, etc., at a cost of $733,868.63, the cost of removing snags, etc., being therein placed at $34,585.10, including contingencies. Following this report, Congress made three appropriations of $10,000 each, by acts approved March 3, 1875, August 14, 1876, and June 18, 1878, which sums were applied to clearing the river of obstructions below South Bend.

The expenditures to June 30, 1879, were $117,457.

From 1879 to 1893 no work for improvement of the river has been undertaken. Under the appropriations above named, the removal of obstructions cleared the way over long stretches of the river between Minnesota Falls and a point about 30 miles below Henderson (16.7 miles above Shakopee).

Little or no use was made of the cleared channels, as there was not sufficient water in the channel to permit navigation during low-water periods. The rapidly caving banks on the upper section of this stream cause snags and leaning trees to form, so that channels that were cleared of them thirteen years ago are more or less encumbered with them to-day.

Amount expended to June 30, 1894, including outstanding liabilities, $126,926.

Previous to the fall of 1893 no expenditures had been made for the improvement of the lower part of the river, which affords much better facilities for river traffic than the upper part.

From Shakopee to the Mississippi River the river is deep except on two bars. There are few snags on this reach.

The river and harbor act of August 11, 1888, appropriated $10,000 for improving the Minnesota River, including the protection of the banks opposite the borough of Belle Plaine. It appearing from an examination made in September, 1888, that the sum was inadequate for the purposes named, its expenditure for work of improvement was deferred until the further wishes of Congress in the matter might be known.

The river and harbor act of July 13, 1892, made the sum available for the improvement of the river, omitting the requirement for operations at Belle Plaine. It was expended during September, October, and November, 1893, at the mouth in closing the main outlet of the river by a dam of brush and stone and dredging a channel through the Fort Snelling chute. This plan of improvement was adopted in order to take advantage of the fall, during low stages, of 1½ feet between the Mississippi and Minnesota rivers at Fort Snelling. The improvement, when permanently completed, will raise, during low water, the pool from Shakopee to the mouth (24 miles) 1½ feet, and will extend navigation to the lower end of the town of Carver, 30 miles above the mouth. Owing to the incomplete state of the improvement at the mouth, the long continued high water during the spring of 1893 damaged the work to a considerable extent. During the past year the funds available sufficed only to make minor repairs to the dam at the mouth and dredge a temporary channel through a bar in the Fort Snelling cut.

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July 1, 1894, balance unexpended	$590.50
June 30, 1895, amount expended during fiscal year	98.63
July 1, 1895, balance unexpended	491.87
July 1, 1895, outstanding liabilities	491.87
Amount (estimated) required for completion of existing project	693,868.63
Amount that can be profitably expended in fiscal year ending June 30, 1897	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix Y 6.)

7. Red River of the North, Minnesota and North Dakota.—The project for improvement of this river from Breckenridge to the northern boundary line, adopted in 1877, modified in 1887, and amended as to cost in 1883, 1887, and 1893, consists in removal of snags, leaning trees, and bowlders, and in dredging channels through the bars, at an estimated cost of $307,320.

Before improvement the ruling depth on the bars between Moorhead and Goose Rapids, at ordinary low water, was but 1½ feet, and below Grand Forks 2 feet, while between Moorhead and Abercrombie the navigation was at all times difficult.

The work to June 30, 1894, resulted in opening a channel 3 feet deep at ordinary low water and 60 feet wide from Moorhead to Grand Forks, except a stretch of 14 miles near upper end of Goose Rapids, and a 4-foot channel at low water, 60 feet wide, from Grand Forks to the boundary line; also in the removal of snags and trees between Moorhead and Abercrombie, so as to afford a safe passage for steamers between those points during high and medium stages of water.

The total amount expended, including outstanding liabilities, to June 30, 1894, was $239,897.70.

During the year numerous slides occurred north of Grand Forks, necessitating much repair work to the channels. During the past year the dredging work was of this character. No new work was commenced.

Last fall and winter one dredging plant was thoroughly overhauled, the other one was dismantled, and the machinery stored.

July 1, 1894, balance unexpended	$353.06
Amount appropriated by act of August 17, 1894	15,000.00
	15,353.06
June 30, 1895, amount expended during fiscal year	9,148.77
July 1, 1895, balance unexpended	6,204.29
July 1, 1895, outstanding liabilities	1,294.19
July 1, 1895, balance available	4,910.10
Amount (estimated) required for completion of existing project	52,320.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	15,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix Y 7.)

8. Gauging Mississippi River at or near St. Paul, Minn.—The Board of Engineers, to whom was referred the project for the application of $37,500 appropriated by the river and harbor act of August 5, 1886, for reservoirs at head waters of Mississippi River, recommended in their report dated May 24, 1887, "that such gaugings be made at or near St. Paul during the annual operation of the reservoirs as shall determine accurately the discharge at that point at critical periods." (Annual Report Chief of Engineers, 1887, p. 1692.)

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The river and harbor act of August 11, 1888, authorized the gaugings, and provided for them as follows:

And the Secretary of War shall cause such gaugings to be made at or near St. Paul during the annual operations of said reservoirs as shall determine accurately the discharge at that point, the cost of the same to be paid out of the annual appropriation for gauging the waters of the Mississippi River and its tributaries.

Gaugings were not made until the fall of 1889, although an allotment of $900 for the fiscal year ending June 30, 1889, had been made. On account of the lateness of the season and the condition of the river it was not deemed advisable to expend any of the money that year.

During the past fiscal year gaugings have been made.

July 1, 1894, balance unexpended	$21.93
Amount allotted for fiscal year ending June 30, 1895	500.00
	521.93
June 30, 1895, amount expended during fiscal year	521.93
Amount allotted for fiscal year ending June 30, 1896	500.00

(See Appendix Y 8.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations of the following localities, required by the act of August 17, 1894, were made by the local engineer, Maj. W. A. Jones, Corps of Engineers, and reports thereon submitted through the division engineer, Col. O. M. Poe, Corps of Engineers:

1. Preliminary examination of Minnesota River, Minnesota, with a view to protecting the banks opposite the borough of Belle Plaine, so as to prevent the river from cutting through the narrow neck of land at that point, and with a view of protecting the banks at and near the city of Mankato.—Major Jones submitted report of examination January 15, 1895. In his opinion, concurred in by the division engineer and by this office, the localities are not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 271, Fifty-third Congress, third session. (See also Appendix Y 10.)

2. Preliminary examination of Big Stone Lake, Minnesota, with a view to construction of reservoirs.—Major Jones submitted report of examination January 16, 1895. He reports that this improvement is legitimately a part of the project creating reservoirs at the head waters of the Mississippi River, and, for the reasons given, considers the locality worthy of improvement. The division engineer is of opinion that "Big Stone Lake, with a view to the construction of reservoirs," is worthy of improvement by the General Government.

The Board of Engineers, in a report of May 24, 1887, upon the subject of reservoirs at head waters of the Mississippi River and its tributaries, made after an exhaustive inquiry, uses the following language: "The further extension of the system of improving low-water navigation by reservoirs in this region is not recommended by the Board." (See Annual Report of the Chief of Engineers for 1887, Part II, pp. 1681–1693.)

The work now proposed is not considered by this office to be an improvement worthy to be made by the General Government.

Major Jones estimates that the surveys necessary for preparation of plan of improvement, with estimates, will cost $3,000.

The report was transmitted to Congress and printed in House Ex. Doc. No. 256, Fifty-third Congress, third session. (See also Appendix Y 11.)

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3. Preliminary examination of Red Lake River, Minnesota, with the view of improving Red Lake River from Thief River Falls to the Red Lake.—The report of the results of this examination was submitted by Major Jones under date of February 26, 1895. It is the opinion of Major Jones, concurred in by Col. O. M. Poe, Division Engineer, and by this office, that the river is worthy of improvement by the General Government.

A survey of the locality is not deemed necessary to the preparation of plan and estimate of cost of improvement. (See Appendix Y 12.)

IMPROVEMENT OF MISSOURI RIVER AT AND ABOVE SIOUX CITY, IOWA, AND OF YELLOWSTONE RIVER, MONTANA AND NORTH DAKOTA.

This district was in the charge of Capt. Harry F. Hodges, Corps of Engineers; Division Engineer, Col. O. M. Poe, Corps of Engineers.

1. Missouri River, between Stubbs Ferry, Montana, and the lower limits of Sioux City, Iowa.—Between Stubbs Ferry and a rapid just below Cascade, a distance of 77 miles, the river is steep and much obstructed by rocks and dangerous rapids. The average low-water slope is 3.73 feet per mile.

Between the rapids just below Cascade and Great Falls, a distance of 54 miles, the fall is very gentle and the river readily susceptible of regulation. The average slope is 0.52 feet per mile, and the natural depth sufficient for a draft of 36 inches, except at six bars, over which the low-water depth is 1.8 feet or more.

Between the Great Falls and Fort Benton, 37 miles below, the channel is unnavigable, being obstructed by rocks and having a very steep slope. No effort has ever been made to improve it, and none is contemplated.

Between Fort Benton and Carroll, 168 miles below, the river had originally a low-water depth of less than 30 inches in places, and is much obstructed by steep rapids and rocks.

Below Carroll the river becomes muddy, with unstable banks and a shifting channel. The difficulties in navigation are chiefly due to sand bars, to snags, and to the width of the river, which is so great in places as to leave little available depth.

The minimum low-water depth changes from year to year with the shifting bars. It was originally sufficient to maintain a considerable commerce.

The projects and works on the river are as follows:

Between Stubbs Ferry and Great Falls.—The project contemplates the removal of snags and bowlders and the construction of closing and wing dams. Before June 30, 1894, no work of river improvement had been done. During the fiscal year ending June 30, 1895, the works projected at two of the bars have been finished and those at the third obstruction begun. The expenditures have been $9,164.90 from the allotment of $20,000 in the river and harbor act of August 17, 1894.

Between Great Falls and Fort Benton.—No work is projected.

Between Fort Benton and Carroll.—The project contemplates the removal of bowlders and the construction of closing and wing dams. Before June 30, 1894, the principal obstructions had been removed and the shoal places deepened as far as practicable. Work had been suspended, as navigation had ceased on this reach. During the fiscal year ending June 30, 1895, no work was done. The balance of $7,801.82 remaining unexpended from the allotments for this work was transferred to the work of removing obstructions and expended in the maintenance and operation of the snag boats.

At Bismarck.—The project contemplates the rectification of the river at and near Bismarck Harbor, so far as the available funds shall per-

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mit. Before June 30, 1894, nothing had been undertaken. During the year ending June 30, 1895, plant has been constructed and work begun on the group of dikes which it is proposed to construct with the funds appropriated.

The expenditures have been $6,496.43 from an allotment of $40,000 in the river and harbor act of August 17, 1894. The work was authorized February 25, 1895.

At Pierre and Fort Pierre.—The project contemplates the rectification of the river at and near Pierre so far as the available funds shall permit. Before June 30, 1894, nothing had been done. During the year ending June 30, 1895, plant has been constructed and work begun on a dam closing the chute in rear of Marion Island and on the group of dikes which it is proposed to construct with the funds appropriated. The expenditures have been $16,952.21 from an allotment of $40,000 in the river and harbor act of August 17, 1894.

At Sioux City.—The project contemplates the extension and completion of certain dikes already put in and the protection of the Iowa bank at Sioux City. Before June 30, 1894, the only work in the vicinity consisted of a group of nine dikes which has been constructed by the Missouri River Commission to check a dangerous erosion along the town front. These dikes had caused an accretion which was a complete protection against further washing, but were threatened with destruction by the current cutting in above them and by damage from ice and drift at the outer ends.

During the year ending June 30, 1893, two dikes were built above the old system, and T heads were put on two of the dikes of the latter. Material was purchased and plant constructed for the protection of the Iowa bank. The expenses have been $9,842.67 from an allotment of $10,000 for the extension of the old dikes and $884.75 from an allotment of $40,000 for the protection of the bank. The former was included in the river and harbor act of August 17, 1894, and the latter in the sundry civil act of March 2, 1895.

Ice harbors.—The project contemplates the construction of one harbor at Rockhaven, N. Dak., and one in the mouth of the Big Sioux River, South Dakota.

Before June 30, 1894, about one-half of the land needed at Rockhaven had been acquired and a small part of the work of construction had been begun. The site needed at the Sioux River had been surveyed, but no steps had been taken toward its purchase, as jurisdiction had not been ceded by the State of South Dakota.

During the year ending June 30, 1895, the work at Rockhaven has been finished on the part of the site to which title had been obtained before the beginning of the year, and the remainder of the land has been purchased. The State of South Dakota has ceded jurisdiction over the land desired at the Sioux River and negotiations for its purcase are pending.

The expenses have been $16,112.89 from allotments aggregating $50,000 from the river and harbor act of July 13, 1892.

Survey.—The project contemplates a complete survey from Fort Benton to Sioux City, with publication of the maps.

Before June 30, 1894, the field work, extending over 1,477 miles of river, had been finished, the platting nearly completed, and the printing about half done.

During the year ending June 30, 1895, the platting has been finished, except two index charts, and the printing nearly completed.

The expenditures have been $16,139.47 from allotments aggregating $140,000 from the river and harbor acts of 1890 and 1892.

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During part of the year the snag boats have been maintained from the general appropriation for river improvement. The expenditures from this appropriation were $27,037 from allotments aggregating $192,847.30 from the river and harbor acts of 1890 and 1892.

July 1, 1894, balance unexpended		$93,064.48
Amount appropriated by act of August 17, 1894		110,000.00
Amount appropriated by sundry civil act of March 2, 1895		40,000.00
Amount received from overpayment		5.30
		243,069.78
June 30, 1895, amount expended during fiscal year		108,407.17
July 1, 1895, balance unexpended		134,662.61
July 1, 1895, outstanding liabilities	$34,121.92	
July 1, 1895, amount covered by uncompleted contracts	623.00	
		34,744.92
July 1, 1895, balance available		99,917.69
Amount (estimated) required for completion of existing project		339,310.73
Amount that can be profitably expended in fiscal year ending June 30, 1897		*100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix Z 1.)

2. Removal of snags and other obstructions in the Missouri River above Sioux City, Iowa.—The approved project contemplates the application of the available funds to the stated work on the Missouri River between Stubbs Ferry and Sioux City.

Two special appropriations aggregating $100,000 have been made for this purpose in the sundry civil acts of March 3, 1893, and August 18, 1894.

Before June 30, 1894, a fleet of three snag boats had been purchased, constructed, and operated with funds provided from allotments aggregating $193,152.77 from the appropriations for the general river improvement and the special appropriations above named.

During the year ending June 30, 1895, the boats have been operated and kept in repair. The aggregate time was equivalent to 459 working days for one boat. The results were 1,126 snags and miscellaneous obstructions and 454 rocks removed, 1,921 trees cut on caving banks, and 6,636 miles of river passed over.

One of the boats was furnished with a new boiler and condenser.

The expenditures were $45,899 from the allotments and appropriations already mentioned.

July 1, 1894, balance unexpended		$4,516.41
Amount appropriated by sundry civil act approved August 18, 1894		50,000.00
		54,516.41
June 30, 1895, amount expended during fiscal year		18,862.00
July 1, 1895, balance unexpended		35,654.41
July 1, 1895, outstanding liabilities	$6,612.36	
July 1, 1895, amount covered by uncompleted contracts	2,600.00	
		9,212.36
July 1, 1895, balance available		26,442.05
Amount (estimated) required for work annually		50,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1886 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix Z 2.)

* Not including $50,000 annually for removing obstructions.

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3. Yellowstone River, Montana and North Dakota.—Originally the channel of the river was so obstructed by rocks, swift rapids, sharp turns, and insufficient depth at bars as to be nearly impassable to any vessel at low water.

The original project contemplated rock removal at various points of the river and the construction of closing dams and wing dams at some places below Glendive. A survey was also projected.

Up to June 30, 1892, a total of $103,029.13 had been expended on the improvement and $19,000 on the survey. The result has been to give a navigable channel of 3 feet depth at the points improved above Glendive and 3 feet or more at the points improved below that place. The survey has been finished. During the year ending June 30, 1895, no work has been done. As a large percentage of the available funds would be required simply to initiate work, and for the reason that there is no present or prospective demand for aid by navigation, the project is suspended for further action of Congress. There was formerly a brisk traffic. There is none now.

July 1, 1894, balance unexpended	$11,720.58
June 30, 1895, amount expended during fiscal year	.17
July 1, 1895, balance unexpended	11,720.41

(See Appendix Z 3.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations of the following localities, required by the act of August 17, 1894, were made by the local engineer, Capt. H. F. Hodges, Corps of Engineers, and reports thereon submitted through the division engineer, Col. O. M. Poe, Corps of Engineers:

1. Preliminary examination of the Nebraska side of the Missouri River opposite Sioux City, Iowa.—Captain Hodges submitted report of examination November 16, 1894. He considers the part of the Missouri River covered by the present examination worthy of improvement to the extent necessary for the protection of the caving bank between the revetments already constructed on the South Sioux City front, and his views and conclusions are concurred in by the division engineer and by this office. No detailed survey is necessary in order to submit a plan and estimate of cost of improvement. The report was transmitted to Congress and printed in House Ex. Doc. No. 48, Fifty-third Congress, third session. (See also Appendix Z 4.)

2. Preliminary examination of Tongue River, Montana, with a view of straightening its channel along the eastern edge of the Fort Keogh Military Reservation.—Captain Hodges submitted report of examination September 27, 1894. It is his opinion, concurred in by the division engineer and by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 75, Fifty-third Congress, third session. (See also Appendix Z 5.)

IMPROVEMENT OF CUMBERLAND RIVER, TENNESSEE AND KENTUCKY, AND OF OBION, FORKED DEER, AND CANEY FORK RIVERS, TENNESSEE.

This district was in the charge of Capt. John Biddle, Corps of Engineers; Division Engineers, Col. C. B. Comstock, Corps of Engineers, to February 3, 1895, and Col. H. M. Robert, Corps of Engineers, since February 5, 1895.

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1. Obion River, Tennessee.—This stream flows wholly within the State of Tennessee and is a tributary of the Mississippi, which it enters about 95 miles above Memphis. It rises in the western part of that State, runs in a southwesterly direction, and has a length of about 75 miles. An examination was made in 1880 and a survey was made in 1891 under the provisions of river and harbor act approved September 19, 1890, from Obion to the mouth of the river, a distance of about 68.8 miles, the river in this distance having a fall of 27 feet.

The obstructions were found to be heavy drift, snags, overhanging trees, and a tortuous channel.

The project consists of removing surface obstructions, constructing wing dams at the worst shoals, straightening the channel by cutting through several sharp "bends," making the "cut-offs" sufficiently wide and deep by clearing, grubbing, and excavating, closing the old channel by means of pile and brush dams, to secure a navigable channel not less than 3 feet deep at lowest stages, estimated to cost $50,000, of which $15,000 have been appropriated.

The total amount expended, including outstanding indebtedness, to the close of the fiscal year ending June 30, 1894, was $7,264.68, which has resulted in securing a greatly improved channel between Obion and Lane Ferry, Tenn., a distance of about 22 miles, by clearing away snags, drift gorges, and overhanging trees. In May, 1893, a small steamboat worked up from Fleischhauer mills with two barges of lumber, etc., in tow, the first boat to ascend this stream during fifty years. During the present fiscal year work was carried on from September 22, 1894, to February 28, and from April 22 to May 28, 1895, clearing the channel of surface obstructions, especially drift gorges, from Obion, Tenn., to the mouth of the river.

Amount expended, including outstanding indebtedness, was $4,170.65.

July 1, 1894, balance unexpended	$247.32
Amount appropriated by act of August 17, 1894	7,500.00
	7,747.32
June 30, 1895, amount expended during fiscal year	4,138.35
July 1, 1895, balance unexpended	3,608.97
July 1, 1895, outstanding liabilities	32.30
July 1, 1895, balance available	3,576.67

Amount (estimated) required for completion of existing project	35,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	6,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix A A 1.)

2. Forked Deer River, Tennessee.—[This work was in the charge of Capt. J. H. Willard, Corps of Engineers, until October 11, 1894]. The stream lies wholly in the State of Tennessee. It is formed by the junction of the North and South Forks, about 8½ miles below Dyersburg; flowing southwesterly, it enters the Obion River 3½ miles above its mouth or junction with the Mississippi, about 95 miles above Memphis. Examinations of the North Fork, South Fork, and main stream have been made. The obstructions found in each stream were surface obstructions generally. The project provides for removing snags, logs, leaning timber, etc., so as to give greater ease and safely to navigation. The original estimates of cost were, $19,250 for South Fork below Jackson; $4,500 for North Fork, and $7,000 for the Forked Deer River (main stream), based on plans for removing the obstructions in one sea-

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son. New obstructions are formed each year, and therefore no estimates for permanent improvements have been made.

The amount expended to June 30, 1894, in the removal of surface obstructions was $24,628.22: Upon the South Fork, $12,500; upon the North Fork and main river, $12,128.22. These expenditures resulted in putting both forks in fairly navigable condition; the removal of the obstructions enabled small flatboats to navigate with ease and safety.

No work has been done in South Fork since 1889. The work done in North Fork has enabled boats to run to Dyersburg at a stage of water 3 feet lower than formerly.

During July of the present fiscal year a small working force was employed clearing surface obstructions from the channel of the main stream between Skippers Cut-off and mouth of river. A small boat of not to exceed 2½ feet draft can now navigate the main stream at any time of the year. Work was suspended July 7, 1894, the available funds being nearly exhausted. Amount expended during the fiscal year, $268.03.

The Tennessee legislature at its last session passed an act "to declare the South Fork of the Forked Deer River navigable from Yellow Bluff levee and bridge to its mouth, and to repeal so much of an act passed March 23, 1883, as makes said river navigable above that point."

July 1, 1894, balance unexpended	$371.78
June 30, 1895, amount expended during fiscal year	268.03
July 1, 1895, balance unexpended	103.75
July 1, 1895, outstanding liabilities	11.33
July 1, 1895, balance available	92.42

(See Appendix A A 2.)

3. Cumberland River, Tennessee and Kentucky.—a. Below Nashville (191 miles).—An examination was made of this section in 1871, and the channel was found to be of the same general character throughout its entire length and obstructed by rock reefs, bowlders, gravel and sand bars, snags, and overhanging trees.

The original project provides for the removal of the surface obstructions and deepening the channel by excavation and the building of wing dams. This project was modified in 1888, on the recommendation of a Board of Engineer Officers, by the proposed construction of a pile dike with crib superstructure for the improvement of the channel at the mouth of the river, from Smithland to the deep waters of the Ohio, for which Congress made provision in river and harbor act of September 19, 1890. A survey was made in 1889, having in view a project for the radical improvement of the river below Nashville, and "to ascertain if necessary to establish locks and dams." The river and harbor act of July 13, 1892, provided for the selection and purchase of sites for a lock and dam near the mouth of Harpeth River. This forms the initial movement for work under the modified and existing project, which consists (first) of the extension of the lock and dam system of the Upper Cumberland to the river below Nashville, the plan being the construction of locks and dams extending from near mouth of Harpeth River (Lock A) to Big Eddy Shoals (Lock G); (second) of the improvement by dike construction and bank protection at the mouth of the river: (third) of the channel work necessary below Big Eddy Shoals, and (fourth) snagging and removal of surface obstructions below Nashville, at a total estimated cost of $1,964,500.

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The total amount expended to June 30, 1894, including outstanding indebtedness, was $322,779.21; of this amount, $303,639.14 was expended under the old project for open channel work and $19,140.07 under the new project providing for the canalization of the river below Nashville, in part, and for its general improvement and the maintenance of the advantages already secured. This expenditure has resulted in obtaining an increased depth at low water, thereby securing a lengthened season of navigation, combined with greater security in passage at some of the worst obstructions. The channel has been cleared from year to year of snags and other surface obstructions. A pile dike was built at the mouth of the river under contract and riprap protection placed on the shore of Cumberland Island and on the bank above foot of island opposite the Kentucky mainland; the bank is now thought to be permanently protected from erosion. Harpeth Shoals are the most formidable obstruction to the navigation of the Lower Cumberland, and to overcome this obstacle the present project has in view that the lock and dam near mouth of Harpeth River, 39 miles below Nashville, be pressed to completion as rapidly as possible. As provided by act of July 13, 1892, the necessary sites were selected and approved by the Secretary of War for the proposed lock and dam (A), about 2½ miles below mouth of Harpeth River. The sites were condemned, lock site paid for, and title vested in the United States.

During the present fiscal year the site for abutment of dam (A) has been acquired by condemnation, paid for, and titled vested in the United States. The necessary temporary buildings at the lock site were begun in June and are nearly completed ready for use. Machinery has been moved to the site; grading incline, setting up engines, construction of tramways, and other preparatory work necessary before building cofferdam and preparing foundation for lock walls have been carried on. The limited amount of funds available for this work renders it impracticable to do more than pertains to the construction of cofferdam and excavation of lock pit. Channel work was carried on from August 21 to December 11, 1894, between Nashville and mouth of river, removing surface obstructions, reducing rock reefs, repairing dams, etc.; special improvements were effected at Cumberland City Landing, Dover Landing, near Canton, Ky., and at Dycusburg, because at these localities outcropping rock points rendered the channel very dangerous; willows were planted as bank protection at the Gatlin Shoals, at Line Island, at Race Track dams, and at other points, and the dam at Cam Owens, 36 miles below Nashville, was repaired. The amount expended, including outstanding indebtedness, during the fiscal year was, for general improvement, $9,740.30; lock and dam near mouth of Harpeth River, $2,432.23; at mouth of river, $387.65; total, $12,560.18.

July 1, 1894, balance unexpended	$22, 736. 99
Amount appropriated by act of August 17, 1894	30, 000. 00
	52, 736. 99
June 30, 1895, amount expended during fiscal year	7, 969. 30
July 1, 1895, balance unexpended	44, 767. 69
July 1, 1895, outstanding liabilities	4, 590. 88
July 1, 1895, balance available	40, 176. 81
Amount (estimated) required for completion of existing project	1, 894, 500. 00
Amount that can be profitably expended in fiscal year ending June 30, 1897	150, 000. 00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

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b. Above Nashville.—From Nashville to head of Smith Shoals (337 miles).—The present project is based on an instrumental survey of this section made in 1883, and provides for the complete canalization of the river from Nashville to head of Smith Shoals by the construction of 23 locks and dams below Burnside, and 7 locks and 2 dams at Smith Shoals, at an estimated cost of $7,500,000. Of this amount $975,000 has been appropriated.

The amount expended to June 30, 1894, including outstanding indebtedness, but not including the amount pledged under contracts, was $500,715.85; of the amount $11,015.67 was expended at Smith Shoals. This expenditure has been applied in the examinations for sites of locks and abutment of Dams Nos. 1 to 7; purchase of sites for locks and abutments Nos. 1 to 5, and fencing same; completing examinations for sites of Locks and Abutments Nos. 1 to 5 of the Smith Shoals system; building Lock and Abutment No. 1 by contract; building lock keeper's house at Lock 1; building cofferdam at old site of Lock 2, and payments for plant, etc., in settlement of contract terminated for building masonry of said lock; clearing sites, erecting temporary buildings, and fitting up steam travelers at Locks 2 (new site), 3, and 4; building cofferdams and landing piers, excavating lock pits and laying brickwork in foundation of river walls and filling culverts of Locks 3 and 4; purchasing stone for masonry of Lock 3; quarrying and cutting stone and laying masonry of river wall of Lock 4 by hired labor; procuring and repairing floating plant; clearing channel of surface obstructions; reducing rock ledges and gravel bars; extending and building riprap dams at several points.

During the present fiscal year work was prosecuted under the hired-labor system; stone for masonry of Locks 2 and 5 being obtained under contracts made October 13, 1894, and January 19, 1895, respectively.

Operations were carried on at Locks Nos. 2, 3, 4, and 5; land needed at Lock No. 6 has been acquired; sites for locks and abutments of Dams Nos. 7, 8, 21, and 22 have been approved.

The proposed dam at Lock 22 will back the water up to Lock No. 1 of the Smith Shoals system.

The land already acquired by the United States for canal purposes on the Cumberland River above Nashville aggregate 87.46 acres and cost $10,546.59.

The U. S. steamers *Weitzel*, *John Phœnix*, and *Stephen H. Long* were actively employed upon the works in towing, surveying, etc. The *Long* was returned to the Tennessee River in January as belonging to the works upon that stream.

The U. S. steamer Susette.—Authority was granted to construct a small steamboat for use upon the work of lock construction. The work was progressing at close of fiscal year.

Channel work.—The removal of surface obstructions, repairing, and extending dams, etc., was continued from July to December, inclusive. In July and August the channel was cleared from near Carthage to Nashville, Tenn. In August the work of repairing and extending the dams at Fishing Creek Shoals and Forbush Shoals, a few miles below Burnside, Ky., was begun and completed in October. From Forbush Shoals the working party moved down stream, clearing the channel to Lower Hollemans Island, where operations were suspended December 11, 1894.

Total amount expended during the fiscal year, $300,234.73.

Smith Shoals.—A line of levels was run from Burnside to Mill Springs, Ky., to establish the pool level below Lock 1; examinations

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and borings were made, having in view the selection of sites for lock and abutment of Dam No. 6 of the Smith Shoals system; examinations were completed in September and lock and abutment located; survey was made of mouth of "Suck;" a line of levels was run into the cave at Cave Creek; property lines at the several lock sites were run, marked, referenced, and lines shown to owners. Total amount expended during fiscal year on account of allotments "at Smith Shoals," $4,727.91.

The report of the survey of the section of the river from Burnside, Ky. (mouth of South Fork of Cumberland), to mouth of Rock Castle River; also maps of the proposed sites for locks and abutments of Dams Nos. 1 and 2, recommended for approval, were prepared during the fiscal year.

The total amount expended during the fiscal year for improving Cumberland River above Nashville, Tenn., was—

General improvement (canalization and open-channel work)		$300,234.73
At Smith Shoals		4,727.91
Total		304,962.64
July 1, 1894, balance unexpended		325,051.17
Amount appropriated by act of August 17, 1894		200,000.00
		525,051.17
June 30, 1895, amount expended during fiscal year		304,962.64
July 1, 1895, balance unexpended		220,088.53
July 1, 1895, outstanding liabilities	$7,020.60	
July 1, 1895, amount covered by uncompleted contracts	110,553.24	
		117,573.84
July 1, 1895, balance available		102,514.69
Amount (estimated) required for completion of existing project		6,525,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		450,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix A A 3.)

4. Caney Fork River, Tennessee.—This stream, after a course of about 200 miles, wholly in the State of Tennessee, empties into the Cumberland River at Carthage, Tenn., about 116 miles above Nashville, Tenn. It is the largest tributary of the Cumberland River.

An examination was made in 1879 as high up as Sligo Ford, about 72 miles, and in 1886 it was extended 20 miles farther to Frank Ferry, the head of navigation. The principal difficulties were found to be rock reefs, gravel and sand bars, a crooked, shallow channel, greatly impeded by surface obstructions.

The present project is to improve the river below Frank Ferry, 92 miles, by removing drift and other surface obstructions, and building the wing dams and training walls necessary to insure safe navigation for small steamboats and flatboats during the boating season, usually about five months in duration, from February to July.

The amount expended to June 30, 1894, including outstanding indebtedness, was $25,000, the total amount appropriated, which was used in removing surface obstructions, in reducing sand and gravel bars, and in repairing and building dams, and has resulted in a greatly improved channel from Frank Ferry to mouth of river.

Work in the channel was suspended August 15, 1891, the appropriation being then nearly exhausted. No appropriations were made for this river by the acts of July 13, 1892, and August 17, 1894.

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The engineer officer in charge in view of the limited commerce to be benefited, is of the opinion that further appropriations can not be profitably expended upon this stream.

July 1, 1894, balance unexpended	$20.00
July 1, 1895, balance unexpended	20.00
July 1, 1895, outstanding liabilities	20.00
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	20,228.00

(See Appendix A A 4.)

SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The survey of *Forked Deer River from Dyersburg, Tenn.*, to its junction with the Obion River, and thence to the Mississippi River, so as to make said streams navigable all the year, required by the act of August 17, 1894, was made by the local engineer, Capt. John Biddle, Corps of Engineers, and his report of December 18, 1894, submitted through the division engineer, Col. C. B. Comstock, Corps of Engineers. Captain Biddle is of the opinion that no satisfactory channel can be obtained on the Forked Deer River all the year by means of open-channel works, and that the cost of a slack-water system of navigation, with lifts not to exceed 6 or 7 feet, will reach $400,000 and be very expensive to maintain. The report was transmitted to Congress and printed in House Ex. Doc. No. 156, Fifty-third Congress, third session. (See also Appendix A A 5.)

IMPROVEMENT OF TENNESSEE RIVER AND ITS TRIBUTARIES.

The works in this district were in the charge of Capt. G. W. Goethals, Corps of Engineers, and of Capt. John Biddle, Corps of Engineers, to December 20, 1894, and of Capt. T. A. Bingham, Corps of Engineers, since that date, with Lieut. James F. McIndoe, Corps of Engineers, under the immediate orders of the officer in charge, since October 9, 1894. Division Engineers, Col. C. B. Comstock, Corps of Engineers, to February 3, 1895, and Col. H. M. Robert, Corps of Engineers, since February 5, 1895.

1. Tennessee River.—a. Above Chattanooga, Tenn. (188 miles).—This section of the river extends from the mouth of the French Broad River to Chattanooga, and is usually navigable during the winter and spring months. Examinations were made in 1830 and 1871, and a detailed instrumental survey in 1891–1893. The obstructions were described as "low-water obstructions," consisting of reefs, rock or gravel bars, and snags, etc., brought down by freshets. The depth of these bars varies from 10 to 30 inches at a low-water stage, the current being from 2½ to 6 miles per hour.

The original project, under which the work is still carried on, was to blast a channel through the reefs, reduce the gravel and sand bars, and to deepen the water on the bars by the construction of wing dams, thus contracting the waterway so as to secure a safe, navigable channel 3 feet in depth at average low water.

The report, with estimates, of the "careful and comprehensive survey" made in compliance with the river and harbor act of September 19, 1890, was rendered February 23, 1893, and is printed in House Ex. Doc. No. 252, Fifty-second Congress, second session, and in Report of the Chief of Engineers, 1893, page 2333 et seq. The project therein sub-

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mitted is practically the same as that now in force, providing for a 3-foot low-water navigation between Chattanooga and mouth of French Broad River by channel excavation and the construction of wing dams to contract the waterway at low water, at an estimated cost of $650,000.

The amount expended, including outstanding indebtedness, to June 30, 1894, was $301,895.08, which expenditure has resulted in securing a lengthened season of navigation for steamboats and a safer channel for the passage of rafts and flatboats. Of the 43 obstructions enumerated in 1830, channel work has been carried on to the extent of improving at least 29 of them. Owing to the character of the banks these improvements are practically permanent. At White Creek Shoals the longitudinal dam has been lengthened and two spur dams built, causing the removal of the sand bar. At Soddy Shoals the channel has been cleared of surface obstructions, new dams built and old dams strengthened, and good progress made in drilling and blasting the rock ledges on reefs forming this obstruction. At Caney Creek Shoals the building of riprap dams was begun.

During a part of the present fiscal year work upon the dams and channel excavation was continued at Caney Creek Shoals, but the stage of water remaining too high to permit of carrying on work to advantage, the working force was transferred to the French Broad River. It not being deemed advantageous with the limited funds available to resume operations late in the season, the boats, etc., were dropped down to Chattanooga for winter moorings as a measure of economy.

The amount expended during the fiscal year was $9,049.37.

July 1, 1894, balance unexpended	$2,744.17
Amount appropriated by act of August 17, 1894	50,000.00
	52,744.17
June 30, 1895, amount expended during fiscal year	9,049.37
July 1, 1895, balance unexpended	43,694.80
July 1, 1895, outstanding liabilities	901.66
July 1, 1895, balance available	42,793.14
Amount (estimated) required for completion of existing project	600,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	15,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

b. Below Chattanooga, Tenn.—The original condition of the river from Chattanooga to Browns Ferry, as shown by examinations made in 1867 and subsequently, was unfavorable to navigation, the channel being obstructed by rock reefs, bars, bowlders, and projecting rocky points, permitting the passage of vessels from six to nine months annually. From Browns Ferry to Florence it was navigable only at unusually high-water stages, owing to the obstructions known as Big and Little Muscle shoals. Navigation between Florence and Riverton, Ala., was limited to about six months annually, owing to the obstructions known as Colbert and Bee Tree shoals.

The existing project of improvement is as follows:

(1) Removing obstructions by blasting and dredging at Ross Towhead, in "The Suck," and at Bridgeport and Guntersville, Ala.

(2) Building a canal 14.5 miles long, 70 to 120 feet wide, and 6 feet deep to permit navigation past the river obstructions known as Big Muscle Shoals, the canal to have 9 locks, each 60 feet wide by 300 feet long, and to cross Shoal Creek by means of an aqueduct 900 feet long and 60 feet wide. Constructing a canal 1½ miles long, to enable vessels

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to avoid the obstruction known as the Elk River Shoals; this canal to have 2 locks, one at each end.

(3) Blasting a channel through bed rock and building wing dams at Little Muscle Shoals; the project, as modified in 1890, contemplates the building of a canal along the north bank of the river 3 miles long, with 2 locks.

(4) Constructing a canal 8 miles long, 150 feet wide, and 7 feet deep past the Colbert and Bee Tree shoals obstructions, with 1 guard lock at the upper and 1 lock with 25-foot lift at the lower end; these locks to be 80 feet wide and 350 feet long.

(5) Protecting Livingston Point, Kentucky, from destruction by revetments of stone and brush carried well down the bank below the water surface, supplemented by pile and stone dikes. This work is necessary to the preservation of the harbor of Paducah, Ky.

The total amount expended to June 30, 1894, including outstanding liabilities, was $3,773,932.94.

Amount expended during fiscal year ending June 30, 1895, including outstanding indebtedness, was $159,722.74, from which the following results have been obtained:

c. Chattanooga, Tenn., to Decatur, Ala. (180 miles).—Navigation has been greatly aided by the removal of rock reefs, bowlders, projecting rocky points, etc., the existence of which before the improvement menaced and retarded navigation.

During the fiscal year ending June 30, 1895, $11,807.78 were expended, principally on the reefs near Bridgeport, Guntersville, and on Beards Reef. The channel at Ross Towhead was also diverted from a broad and shallow one to a more narrow one, giving a good depth of water at all times.

d. Decatur to Florence, Ala. (50 miles).—The principal obstructions to navigation in this section of the river were the Big and Little Muscle shoals. The canal around Big Muscle Shoals was opened to navigation in November, 1890, and navigation through Little Muscle Shoals had been rendered practicable several years before by the construction of wing dams to confine the channel, and excavation.

The cost of these improvements at the time of opening the canal was $2,817,341.18, and $250,000 was subsequently expended in strengthening the canal, building lock masters' houses, and putting the work in durable condition.

e. Florence, Ala., to foot of Bee Tree Shoals (30 miles).—Land amounting to 221.23 acres on the line of the canal around Colbert Shoals was acquired by the United States by purchase and condemnation.

The abandonment by the contractor, Tere A. Clark, of his contract caused its annulment and the prosecution of the work by hired labor. Much delay was caused by preserving the lock pit, which had been partially excavated by the contractor (70,000 cubic yards of material having been removed), from falling in; and before this could be accomplished the levee gave way and the pit was flooded. Since then the work of preparation for construction of lock pit has been as vigorously prosecuted as possible under the unavoidable delays in procuring plant, and a large amount of work has been accomplished—chiefly in purchasing and putting up plant at Riverton and at the Cherokee quarry; consisting of derricks, traveling cableway, hoisting engines, construction of spur track, testing cement, completing detailed designs for construction, erecting levee, excavating sand and gravel from lock pit, etc. Preparation of foundations has begun and the cutting of dimension stone at lock site is well under way.

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f. Foot of Bee Tree Shoals, Alabama, to Paducah, Ky. (225 miles).—With the exception of removing snags, the only work done in this portion of the river was near the mouth, at Livingston Point, which shelters and almost forms the harbor of Paducah, Ky. This point was gradually being reduced by erosion, threatening the safety of the harbor. This danger has been averted, for the present at least, by protecting the exposed points with revetments of brush and piles and by stone dikes, which must, however, be repaired and extended in order to be of permanent value.

July 1, 1894, balance unexpended	$421,697.09
Amount appropriated by act of August 17, 1894	400,000.00
	821,697.09
June 30, 1895, amount expended during fiscal year	134,959.55
July 1, 1895, balance unexpended	686,737.54
July 1, 1895, outstanding liabilities	24,763.19
July 1, 1895, balance available	661,974.35
Amount (estimated) required for completion of existing project, including Livingston Point, Kentucky	5,412,939.81
Amount that can be profitably expended in fiscal year ending June 30, 1897	485,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix B B 1.)

2. Operating and care of Muscle Shoals Canal, Tennessee River.—The canal has been in constant use since it was opened to navigation November 10, 1890. The number of steamboats and barges, exclusive of small craft and Government boats engaged in the improvement of the Tennessee River and care of canal, that used the canal during the year, was 67, with a tonnage of 5,810. A dredge was kept constantly employed removing sediment and in straightening and widening a part of the canal where two sharp curves interfered with the passage of vessels.

There were removed in this way 26,295 cubic yards of material; large quantities of drift logs were also removed during the year.

The total expenses during the year, including outstanding indebtedness, amounted to $64,793.11.

(See Appendix B B 2.)

3. Hiwassee River, Tennessee.—[This work was in the charge of Capt. John Biddle, Corps of Engineers, until January 14, 1895.] This stream rises in the Blue Ridge in North Carolina and Georgia. It flows in a west-northwesterly direction, and enters the Tennessee River about 35 miles above Chattanooga, and 148 miles below Knoxville. On examination made in 1874 the channel was found to be obstructed by rock reefs, gravel bars, snags, and overhanging trees.

The present project consists in narrowing the waterway at the shoal places by building wing dams and excavating the reefs and gravel bars and removing surface obstructions so as to secure a channel 40 feet wide and 2 feet deep at ordinary low water from Savannah Ford to the mouth of the river, about 43 miles.

The amount expended to June 30, 1894, including outstanding indebtedness, was $36,450.11, and has resulted in a partial improvement of the river, securing an increased depth in channel and the removal of surface obstructions, principally below Charleston. Active operations were suspended in September, 1892, the funds available for channel work being then exhausted.

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No appropriations have been made for this work since 1890.

July 1, 1894, balance unexpended	$72.93
July 1, 1895, balance unexpended	72.93
July 1, 1895, outstanding liabilities	23.04
July 1, 1895, balance available	49.89

(See Appendix B B 3.)

4. French Broad River, Tennessee.—[This work was in the charge of Capt. John Biddle, Corps of Engineers, until January 14, 1895.] This stream rises on the western slopes of the Blue Ridge in North Carolina, and enters the State of Tennessee at Paint Rock, and after a course of 121 miles in that State joins the Holston, 4½ miles above Knoxville, thus forming the Tennessee River. By examinations made in 1871 and 1875 the river was found to be obstructed by rock reefs, sand and gravel bars, and surface obstructions, such as bowlders, snags, and overhanging trees. It was not deemed practicable to improve the river above Leadvale, but from this point to the mouth, a distance of about 90 miles, it is projected to remove all surface obstructions, and by excavation and use of wing dams to secure for this distance a channel depth of 2½ feet at ordinary low water. Above the mouth of Nolichucky River (Leadvale) to the boundary line of Tennessee and North Carolina a system of locks and dams is the only feasible improvement, but the amount of commerce does not warrant such an expenditure.

The amount expended to June 30, 1894, including outstanding indebtedness, was $63,523.86. This expenditure has resulted in the improvement of ten of the principal obstructions below Dandridge, by deepening and clearing the channel, constructing and modifying wing dams and revetting the banks where necessary. At Seven Island Shoals the improvements have made upstream navigation possible at lower stages of the river. A general deepening of the channel from 6 to 10 inches has been obtained. At Bryant Shoals navigation has been greatly improved; at Hanging Rock Shoals the channel has been changed from the north to the south side of Brabson Island, and the new channel was cleared of obstructions without detentions of boats; eight dams were built aggregating a length of 2,694 linear feet, and old dams repaired. The work done has proved effective.

During the fiscal year 1894 channel work was continued, and consisted in excavating rock at Nichols Reef; building check dam and 180 feet of spur dam, repairing and extending old dams, and revetting bank at Hanging Rock Shoals; building riprap dam at Denton Shoals; strengthening old dams and building new spur dam from right bank just below Zimmerman Ford.

The amount expended during the fiscal year was $792.95.

July 1, 1894, balance unexpended	$361.33
Amount appropriated by act of August 17, 1894	* 6,000.00
	6,361.33
June 30, 1895, amount expended during fiscal year	792.95
July 1, 1895, balance unexpended	5,568.38
July 1, 1895, outstanding liabilities	1,134.83
July 1, 1895, balance available	4,433.55

* Of the appropriation of $7,000 made by the river and harbor act of August 17, 1894, for improving French Broad and Little Pigeon rivers, $6,000 has been allotted to the French Broad River.

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Amount (estimated) required for completion of existing project	$82,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix B B 4.)

5. Little Pigeon River, Tennessee.—[This work was in the charge of Capt. John Biddle, Corps of Engineers, until January 14, 1895.] Little Pigeon River is formed by the junction of its East Fork and South Fork at Sevierville, in East Tennessee, flows in a northwesterly direction for about 5 miles, and empties into the French Broad River about 32 miles above Knoxville. The stream is obstructed by rock and gravel shoals and rapids, and the object of its improvement would be to facilitate navigation during medium and higher stages.

An examination of the river was made under the provisions of river and harbor act of September 19, 1890, and the reports thereon were printed as House Ex. Doc. No. 159, Fifty-first Congress, second session, and as Appendix E E 8, Annual Report Chief of Engineers, 1891.

The river and harbor act of July 13, 1892, provided that of the $15,000 appropriated for improving French Broad River, $1,000 "may be used in removing the bar or shoal in Little Pigeon River." This sum has been allotted for the removal of the bar near the mouth of the river, described as the only bad shoal below Catlettsburg. The work of reducing the obstructive character of the shoal below Catlettsburg was begun in October at Gass Reef by removing about 90 cubic yards of rock from the channel and placing the same in riprap dam. The large dam in slough just above the mouth of river was repaired, and three small dams built across the small slough on the left bank, thus holding up the water in mouth of river and flooding the shoal above.

Nothing was expended during the fiscal year.

July 1, 1894, balance unexpended	$366.90
Amount appropriated by act of August 17, 1894	*1,000.00
July 1, 1895, balance unexpended	1,366.90

Amount (estimated) required for completion of existing project	8,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

(See Appendix B B 4.)

6. Clinch River, Tennessee.—[This work was in the charge of Capt. John Biddle, Corps of Engineers, until January 14, 1895.] This stream rises in the Cumberland Mountains, in Virginia, and after following a southwesterly course empties into the Tennessee River at Kingston, 104 miles above Chattanooga. About 230 miles of the river flows in the State of Tennessee.

An examination was made in 1875, when the channel obstructions were found to be rock reefs, sand and gravel bars, snags, and overhanging trees.

The present project provides for channel excavation, removing surface obstructions, and the construction of wing dams, so as to secure a safe, navigable channel of 2 feet at ordinary low water from mouth of river to Clinton, about 70 miles, and of 1½ feet from Clinton to Haynes or Walkers Ferry, about 75 miles; but from Haynes to the Tennessee

*Of the appropriation of $7,000 made by the river and harbor act of August 17, 1894, for improving French Broad and Little Pigeon rivers, $1,000 has been allotted to Little Pigeon River.

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State line, 85 miles, the only work practicable is to remove the loose rock and reduce the rock ledges, thus to assist flat-boat navigation during "rain tides."

The total amount expended to the close of the fiscal year ending June 30, 1894, including outstanding indebtedness, was $36,710.54, and has resulted in securing a reduction of the rock reefs, the removal of snags, drift, etc., brought down by the annual floods, and the construction of several heavy riprap dams above and below Haynes. A safe channel was secured at stages of the water from 2 to 3 feet lower than before the improvements were begun. Special advantages in the lower river have been gained at Cloud Shoals, Hibb Shoals, Black Shoals, Bletcher Shoals, and at Llewellyn Shoals. At the last-named obstruction safe navigation is reported possible at a stage of water from 1 foot to 1½ feet lower than before the work of 1892 was begun. Some improvements were also made in 1892 in the channel at Youngs Island. Above Haynes improvements were made at Hunter Shoals, Sycamore Shoals, Hopson Shoals, and Straight Shoals.

Partial examinations were made below the mouth of Powell River, and later below the mouth of Emory River, to ascertain in part what is necessary to be done to improve the channel and obtain a navigable 2-foot low-water depth.

No channel work was practicable during the last fiscal year until November, 1893, when a little work was done by building a riprap dam near Givens Ford, about one-half mile below mouth of Emory River.

The amount expended during the present fiscal year was $177.50.

July 1, 1894, balance unexpended	$2,318.30
Amount appropriated by act of August 17, 1894	2,500.00
	4,818.30
June 30, 1895, amount expended during fiscal year	177.50
July 1, 1895, balance unexpended	4,640.80
July 1, 1895, outstanding liabilities	31.34
July 1, 1895, balance available	4,609.46

Amount (estimated) required for completion of existing project	8,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	2,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix B B 5.)

IMPROVEMENT OF OHIO RIVER AND OF MUSKINGUM RIVER, OHIO.

This district was in the charge of Lieut. Col. Amos Stickney, Corps of Engineers, with Capt. William C. Langfitt, Corps of Engineers, under his immediate orders.

1. Ohio River.—The following is a summary of the work done during the fiscal year:

Dam between Davis and Neville Islands.—The floods of the previous winter having washed out some of the paving, it was replaced and dam put in good condition.

Logstown.—Of the works recommended for this place by a Board of Engineers, the main dike and the training dike at the end of the main dike, unfinished at last report, were completed. The remains of an old dike put in in 1832, reported as removed in 1868, were found to lie diagonally across the proposed channel and prevented the continuance

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of the scour already caused by the dike. That portion of the old dike lying in the channelway was removed. Further work will probably be necessary to render navigation safe and easy at this point.

Clusters Islands.—Work on the four dikes and dam projected for this place, and which was in progress at the close of the last fiscal year, was completed September 28, 1894. Dredging to aid the action of the dikes on the compact gravel was resumed November 12, and between that date and the 28th 17,678 cubic yards of material was removed. While the channel has been materially improved, further work may be necessary. An examination will soon be made to determine this.

Marietta Island.—The dam between this island and the West Virginia shore, by backing up the water above it, caused a cross current which had cut a cross channel and was washing away the head of the island. It was also causing an erosion of the Ohio shore opposite, and was troublesome to navigation. To stop these injurious effects a dam was built across the cut channel and the head of the island protected so far as necessary, 1,479.9 cubic yards of stone being used. Recent examination shows that the work is producing good effects.

Foot of Blennerhassetts Island.—The crossing at the foot of this island has been much complained of by boatmen. The works projected for its improvement consist of one dike and dredging a channel through the bar. The dredging has been finished, 11,680 cubic yards of gravel being removed. The dike, about 550 feet in length, is well under way. The channel has been greatly benefited.

Ice piers.—The river and harbor act of August 17, 1894, provided for the construction of an ice pier at or near Syracuse, Ohio, or Hartford, W. Va., an additional pier at Middleport, Ohio, and enlarging and improving the existing one at Pomeroy, Ohio. The necessary surveys have been made; project for the work is nearing completion.

Guyandotte Bar.—The work projected for the improvement here consists of the construction of four dikes and dredging. The dikes are well under way and the dredging is in progress. Satisfaction has been expressed with the work so far done, and a good low-water channel is expected on its completion.

Rock Bar at mouth of Licking River.—Work on this bar, so far as funds would permit, was carried on October to December, 1894, and during June, 1895, and is still in progress. A total of 6,882.64 cubic yards of material was removed and much more blasted ready for the dredge. The method used has again shown itself extremely economical.

Medoc Bar.—The work projected here consists of the construction of one dike, and the removal of a portion of a dike built in 1871. The latter was removed by dredge work, and the body or core of the new dike was constructed of material removed from the rock bar at mouth of Licking River. Good effects from this work are observed, the channel being greatly improved both in direction and depth. An examination will be made soon to determine definitely what changes have taken place.

Gunpowder Bar.—The work projected consists of the construction of two dikes, their scouring action to be aided by dredging. The dikes are nearing completion, but the dredging has not yet been commenced.

Flint Island.—The work projected consists of the construction of five dikes and dredging a channel through the bar. Three of the dikes are under contract and work on them is in progress. The dredging has been completed by the removal of 14,750 cubic yards of material. An examination is in progress to ascertain the changes taking place.

French Island.—Work on the two dikes and dam projected for the improvement here, and which was in progress at the close of the last

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fiscal year, was completed in November, 1894. The removal of the portion of the old 1832 dike, also in progress at date of last report, proved much more troublesome and expensive than was anticipated, the dike being much longer and wider than the records indicated. Its complete removal, however, is necessary, and a dredging plant is now engaged on that work. Favorable changes have been noted in the channel, and a good low-water channel is anticipated this season.

Vanada Reef and Falls Slough Crossing.—The works projected for the improvement of these points, which are about 1½ miles apart, consist of one dike at each place, together with dredging to supplement and aid their action. The dikes are both under construction.

Scuffletown Bar.—Work under contract on the two dikes projected here, reported as in progress at date of last report, was completed in December, 1894. The effect, so far as observed, has been good. A further examination will be made as soon as possible, after a favorable stage of river occurs.

Cut-off near Evansville, Ind.—The river and harbor act of August 17, 1894, provided funds for preventing a cut-off in the river supposed to be threatening near Evansville, Ind. The necessary survey for determining the best method of carrying out the work has been made.

Three-Mile Island.—The works projected here consist of the construction of six dikes, which are all under contract, and work on them is in progress. In July, 1894, a dredged cut was made through the bar, 1,300 feet long, 35 feet wide, to a depth of 4 feet below low water. This work materially aided navigation during the remainder of the low-water season.

Levee at Shawneetown, Ill.—As required by the river and harbor act of August 17, 1894, this levee has been strengthened and revetted wherever necessary, all necessary repairs made, and the levee put in good condition throughout. No further work is needed.

Bar at mouth of Tradewater River.—Work under contract on the dike projected here, and which was suspended at the close of the last fiscal year, was resumed on August 23, 1894, and the dike was completed for a length of 1,879 feet November 27, 1894, when the contract was annulled by mutual agreement, the completion of the dike to the length contemplated in the original project being held in abeyance, pending future observations on the scouring induced and effects on the proposed channel way. The dike has produced an enlargement of the channel behind the bar, and by removing a hard gravel bar lying in the way a good low-water channel will be produced. A portion of this bar was removed in November and December, 1894, and the United States snag boat removed in December some wrecks, snags, and bowlders. A dredging fleet has been at work there since May 17, 1895. It is believed that in a short time an excellent low-water channel will be obtained.

Mound City, Ill.—Work under contract for the construction of the two dikes projected, reported as suspended at the close of the last fiscal year, was resumed and completed so far as possible in November, 1894, the river not having fallen sufficiently throughout the season to permit all the work designed. The dikes are, however, practically as efficient so far as their effect on the channel is concerned, as if completed, all the stonework having been put in place. Dredging was done here between September 26, 1895, and December 18, 1895, making a cut through the bar and removing some high areas in the channel way. This dredging helped navigation materially, but was much hampered by finding a hard conglomerate which requires drilling and blasting for its removal. Further work is required.

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Operations of the United States dredges.—At the beginning of the present fiscal year the United States dredges were in Pittsburg Harbor. They worked there and at other places throughout the season, going into winter quarters in the mouth of the Muskingum River in December, 1894. After making the necessary repairs, work was again resumed in May, 1895, and at the close of the year they were at work at Guyandotte Bar. They removed during the year a total of 216,584 cubic yards of material, besides a large number of snags, rocks, piles, etc. Their work everywhere was beneficial, and especially so in Pittsburg Harbor and at Guyandotte Bar.

The amount expended up to the close of the fiscal year ending June 30, 1894, was $5,313,319.70.

July 1, 1894, balance unexpended		$187,593.47
Amount appropriated by act of August 17, 1894		250,000.00
		437,593.47
June 30, 1895, amount expended during fiscal year		133,031.81
July 1, 1895, balance unexpended		304,561.66
July 1, 1895, outstanding liabilities	$36,354.38	
July 1, 1895, amount covered by uncompleted contracts	45,443.35	
		81,797.73
July 1, 1895, balance available		*222,763.93
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		450,000.00

(See Appendix C C 1.)

2. Operating snag boat on the Ohio River.—The boat worked during the fiscal year from July 2 to December 19, 1894, and from June 20 to June 30, 1895, removing in this time 1,201 snags, 52 wrecks, 2,182 cubic yards of stone, and 2 leaning trees. The need for a larger appropriation for this work is again decidedly shown by the operations of this year. Owing to lack of funds the boat could not start out until the beginning of the fiscal year. As a result the water got so low that she failed to reach the head waters, and in coming back downstream she grounded on a bar and was detained there for almost two and a half months. Fortunately, there was sufficient work in the vicinity to keep the crew busy in removing a large number of rocks and bowlders, many of them of large size, seriously obstructing the channel over a distance of 24 miles. Total distance traveled was 2,015 miles. The officer in charge again earnestly recommends that the amount of money to be made applicable to this work and the removal of wrecks each year be increased, as the amount, $25,000 per year, now provided by the permanent annual appropriation made by act of September 19, 1890, is not sufficient to keep the snag boat fully employed and in repair. An

*The item in the river and harbor act of August 5, 1886, making an appropriation of $375,000 for improving the Ohio River, provides that $37,500 "or so much thereof as may be necessary, of said appropriation, shall be expended in constructing five ice piers, pursuant to the present or prospective plans of the Chief of Engineers, at or near the following places, to wit: One at Pomeroy, Ohio; one at Middleport, Ohio; one at Gallipolis, Ohio; and one at Ironton, Ohio; and one at Ashland, Ky., on the south side of the Ohio River."

All of the ice piers in question have been completed with the exception of the one at Ashland, Ky., for which it was found impossible to secure the relinquishment of riparian rights required by law. Under these circumstances it is recommended that the unexpended balance of this allotment of $37,500, amounting to $11,402.52, still accounted for as available July 1, 1895, be returned to the fund available for the general improvement of the Ohio River.

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increase to $50,000 per year would, it is believed, enable this service to add greatly to the safety of navigation, and make it satisfactory to the river interests. The amount expended on the work to the close of the fiscal year ending June 30, 1894, was $85,427.40.

(See Appendix C C 2.)

3. Operating and care of Davis Island Dam, Ohio River, near Pittsburg, Pa.—This dam was built to test the adaptability of the system of movable dams to the peculiar conditions of the Ohio River and to the special character of the commerce that navigates it. It was intended to be the first step in the radical improvement of the Ohio River designed to give a minimum depth of 6 feet at all times, except when ice was running. The experiment has been successful, the dam having proved itself of immense benefit to commerce in every way and meeting the approval of all river men. During the fiscal year the lock and dam have been successfully operated without interference with navigation. The dam has been raised and lowered twice, and has been up 204 days during the fiscal year. The cost of operating and care of the dam during the year was $13,054.54.

(See Appendix C C 3.)

4. Movable dam in Ohio River below mouth of Beaver River, Pennsylvania.—Work of construction progressed satisfactorily during the season, about 80 per cent of all work being completed. On January 7, 1895, a sudden rise carried away about 330 feet of the cofferdam, which was old and deteriorated. The loss was of small importance, as the construction of two short spurs connecting each end of the break with the completed part of the river wall again inclosed all work to be done.

Movable Dam No. 2, Ohio River.—The river and harbor act of July 13, 1892, provided for the use of so much of the money appropriated for the movable dam at Beaver as might be necessary for making a survey for the location of a dam (No. 2) and for obtaining title to the land. The survey has been made.

The amount expended on this work up to the close of the fiscal year ending June 30, 1894, was $270,855.56.

July 1, 1894, balance unexpended		$79,144.44
Amount appropriated by act of August 17, 1894		75,000.00
Amount appropriated by sundry civil act approved March 2, 1895		150,000.00
		304,144.44
June 30, 1895, amount expended during fiscal year		75,201.37
July 1, 1895, balance unexpended		228,943.07
July 1, 1895, outstanding liabilities	$6,849.38	
July 1, 1895, amount covered by uncompleted contracts	17,428.59	
		24,277.97
July 1, 1895, balance available		204,665.10

Amount (estimated) required for completion of existing project	325,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	50,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix C C 4.)

5. Ice harbor at mouth of Muskingum River, Ohio.—The object of this work was to furnish a place of refuge for Ohio River craft during ice floods. The project was the construction of a large lock through Dam No. 1, Muskingum River, to permit Ohio River vessels to pass into the pool. There has been expended thereon up to the close of the fiscal year ending June 30, 1894, $327,950.39. The lock is now practically

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completed, with the exception of the machinery for operating the gates and a small amount of masonry required to finish the lock walls. The lock can not be made available for the larger class of steamboats that usually navigate the Ohio and Muskingum rivers until the bridge of the Baltimore and Ohio Southwestern Railroad Company just below it has been changed. The river and harbor act of August 17, 1894, provides for the completion of the lock and the alteration of the bridge. The expense of completing the lock is to be met from the balance remaining to the credit of the "Taylorsville lock appropriation" (improving Muskingum River). Under the act the railroad company is to make the changes required in the superstructure and the United States is to perform the remainder of the necessary work. Payment is to be made from the funds available for the care and maintenance of public works. The work to be done by the United States has been commenced.

July 1, 1894, balance unexpended	$30.68
June 30, 1895, amount expended during fiscal year	4.86
July 5, 1895, balance unexpended	25.82

(See Appendix C C 5.)

6. Muskingum River, Ohio.—This report is limited to work carried on under the appropriation of $102,000 by act of August 11, 1888, for the construction of a lock at Taylorsville and the reconstruction of the lock at Zanesville, Ohio. The lock at Taylorsville is practically completed, with the exception of the machinery for operating the gates, but this lock can not be made available until a draw is placed in the county bridge just below it. The river and harbor act of August 17, 1894, however, made provision for altering this bridge, the superstruction to be changed by the county, the remaining necessary work to be done by the United States, payment therefor to be made from the funds available for the care and maintenance of public works. Plans for the work to be done by the United States have been made. The act of August 17, 1894, also provided for a survey of the Muskingum River from Zanesville to Dresden, to determine the cost of extending slack-water navigation to the latter point. The survey was made and report submitted by Lieutenant-Colonel Stickney under date of February 27, 1895. The estimated cost of the extension is $110,000, exclusive of the cost of altering a bridge spanning the river between the two points. The river and harbor act of August 17, 1894, provided that the funds remaining to the credit of this work should be used in making the survey just mentioned, in completing the Taylorsville Lock, and in completion of the ice harbor at the mouth of the river, thus diverting funds which would be available for alteration of the Zanesville locks to other purposes, and apparently acquiescing in the recommendation of 1889 that these alterations be indefinitely postponed. The locks can be kept in operation some time yet without costly repairs. The amount expended on this work up to the close of the fiscal year 1894 was $88,245.43.

July 1, 1894, balance unexpended	$13,754.57
June 30, 1895, amount expended during fiscal year	1,220.93
July 1, 1895, balance unexpended	12,533.64
July 1, 1895, outstanding liabilities	8.40
July 1, 1895, balance available	12,525.24

(See Appendix C C 6.)

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7. Operating and care of locks and dams on Muskingum River, Ohio.—As originally improved by the State of Ohio, 11 dams and 12 locks were built on the Muskingum River, furnishing continuous navigation for 91 miles, from the Ohio River at Marietta to Dresden, where a connection was made with the Ohio Canal near its middle point, this canal extending from the Ohio River at Portsmouth to Lake Erie at Cleveland. The work cost the State of Ohio about $1,500,000. The lock and dam above Zanesville is now in a state of ruin, but the 75 miles of slack water between the Ohio River and Zanesville has always been maintained. On this piece of river there are 10 dams, 11 locks, and 5 lateral canals, with a total length of 3⅜ miles. The repairs to locks and dams contemplated in the project for fiscal year have been completed and necessary incidental work done. The dikes built during the preceding year to prevent washing below some of the dams have proved very successful, and no further trouble is anticipated. Good navigation was maintained during the past season and the river and structures are in good condition. Through navigation was suspended sixty-four days the past winter by ice; otherwise there was no stoppage. The bridges at Taylorsville and Marietta still constitute great obstructions to navigation on the Muskingum River, the first named preventing the use of the new lock at Taylorsville and the latter preventing the larger class of boats from entering the lock and ice harbor at Marietta and causing much inconvenience and danger to smaller boats. The river and harbor act of August 17, 1894, provides that the changes in these bridges shall be made, the United States to do all the necessary work except that of the superstructures. The changes required in both cases is the substitution of a draw for a fixed span, and the United States, under the act, is to build the pivot piers required, together with the guiding and protecting structures extending above and below the piers. This work has been commenced. The United States dredge and towboat have been usefully employed during the year in various operations for the maintenance of good channels.

The cost of operating and care of these works during the year was $41,851.07.

(See Appendix C C 7.)

8. Removing sunken vessels or craft obstructing or endangering navigation.—On January 21, 1895, two barges of coal were wrecked at Phillissi Island, Ohio River, one of which lay broadside across the channel. Written abandonment being given by the owner, the barge obstructing the channel was removed.

(See Appendix C C 8.)

EXAMINATION AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examination and surveys of the following localities required by the act of August 17, 1894, were made by the local engineer, Lieut. Col. Amos Stickney, Corps of Engineers, and reports thereon submitted:

1. Preliminary examination at Ironton, Ohio, with a view of protecting the Ohio River front within the limits of the city.—Lieutenant-Colonel Stickney submitted report of examination January 12, 1895. In his opinion, concurred in by this office, the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 212, Fifty-third Congress, third session. (See also Appendix C C 9.)

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2. Survey of Evansville Harbor, Indiana.—Lieutenant-Colonel Stickney submitted report of survey February 27, 1895. The work recommended by him for the improvement of this locality is the construction of a series of dikes to properly direct and confine the flow of the river at low stages, a modification of the existing dike, which consists principally in reducing its height, and the protection of the caving bank opposite the existing dike, at a total estimated cost of $39,592.25. The report was transmitted to Congress and printed in House Ex. Doc. No. 352, Fifty-third Congress, third session. (See also Appendix C C 10.)

3. Survey of Muskingum River, Ohio, from Zanesville to Dresden.—The river and harbor act of August 17, 1894, provides for a survey of Muskingum River from Zanesville to Dresden with a view to its improvement, and report of the results of this survey was submitted by Lieutenant-Colonel Stickney under date of February 27, 1895.

The object of this improvement is to extend the navigation of the Muskingum River to Dresden, at which point connection would be made with the Ohio Canal, thus forming a through route of navigation from Lake Erie at Cleveland to the Ohio River at Marietta, and Lieutenant-Colonel Stickney reports that, from information gained by this survey, it is ascertained that to provide navigation to Dresden with channel not less than 6 feet in depth, one lock and dam will be required with a lift of about 11 feet. On account of the probability of small damages to be paid for overflow of land below Symmes Creek and some dredging necessary below the site selected for the lock, and to provide for contingencies, the total cost of the work proposed is estimated at $110,000. (See Appendix C C 11.)

Lieutenant-Colonel Stickney was also charged with the duty of making surveys of—

1. Harbor at Elizabethtown, Ill.

2. Ohio River, movable dams numbered 3, 4, and 5.

The reports of the results of these surveys will be duly submitted when received.

IMPROVEMENT OF CHEAT, MONONGAHELA, AND ALLEGHANY RIVERS, WEST VIRGINIA AND PENNSYLVANIA.

This district was in the charge of Maj. R. L. Hoxie, Corps of Engineers; Division Engineer, Col. O. M. Poe, Corps of Engineers.

1. Monongahela River, West Virginia and Pennsylvania.—The seven lower locks and dams on the Monongahela River belong to the Monongahela Navigation Company, and they create slack water from Pittsburg to Dunkard Creek, a distance of 88 miles. Locks and Dams Nos. 8 and 9 belonging to the United States, continue the slack water to Morgantown, a farther distance of 14 miles. The originally adopted project for the improvement of this river was the construction of two locks and dams to continue slack water to Morgantown, W. Va. This improvement was completed in 1889.

Lock No. 10.—By the river and harbor act of July 13, 1892, the sum of $25,000 was appropriated for beginning work on Lock and Dam No. 10. A careful examination has been made of the river in the vicinity of Morgantown, W. Va., for a distance of about 2½ miles, measured along the river, for the purpose of fixing definitely upon a site for Lock and Dam No. 10. The interests of navigation appear to require that the site should be fixed at Falling Run, below Morgantown, and this location appears to be an advantageous one for the town. Local opposition having been encountered, the objections made are now under con-

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sideration with a view to reconciling, if possible, conflicting interests. The appropriation available is not sufficient to justify the commencement of work.

Lock and Dam No. 10 will be first in a series of six required for the completion of slack-water navigation to Fairmont. Projects have been presented from time to time for this improvement but none have been definitely approved as yet. The appropriation of $25,000 in 1892 for the extension of the improvement of the Monongahela, is in line with the recommendations heretofore made, but this improvement will be of little value until completed. The cost of the entire work, including lock keepers' dwellings and the necessary outbuildings for each lock, will be about $1,320,000, an average of $220,000 for each lock and dam.

The amount expended on this work up to the close of the fiscal year ending June 30, 1894, is $440,435.92.

July 1, 1894, balance unexpended	$21,464.08
Amount appropriated by act of August 17, 1894	20,000.00
	41,464.08
June 30, 1895, amount expended during fiscal year	463.49
July 1, 1895, balance unexpended	41,000.59
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	20,000.00

(See Appendix D D 1.)

2. Operating and care of Locks and Dams Nos. 8 and 9, Monongahela River.—During the past fiscal year these locks have been successfully operated without interruption to navigation, except from December 27, 1894, to January 17, 1895, and from January 28 to March 6, 1895, during which periods the Monongahela River was closed by ice, compelling the suspension of navigation; also on March 17 navigation was again interrupted by a freshet which overflowed both locks.

From Pools 8 and 9 obstructions were removed aggregating 2,437 tons of snags, logs, trees, etc.

At Lock No. 8 repairs were made to the bank protection and operating machinery and lumber procured for repairing fences. The apron of the dam sustained some injury from the ice and high water of the past winter, and will need repairs. The repair of this dam was contemplated at the date of the last annual report, but a careful inspection, made at extreme low water, when the crest of the dam was accessible, indicated no change since 1891, and it was decided not to disturb the dam merely for the purpose of lowering the crest. No change is apparent at this date, but a critical examination will be made during the present season to determine whether any work should be done upon it.

At Lock No. 9 the Stoney valve was repaired, as well as the stone arch over the opening for the valve. Lumber for rebuilding outbuildings was procured; new lock gates were constructed. Repairs were made on the dry wall below the abutment on west side of river. The dam is in good condition.

The cost of operating and care of these locks and dams during the last fiscal year was $17,248.41.

(See Appendix D D 2.)

3. Purchase of Lock and Dam No. 7, Monongahela River.—The river and harbor act of August 11, 1888, made provision for the acquisition by the United States, by purchase or condemnation, of this lock and dam

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from the Monongahela Navigation Company. Condemnation proceedings for this purpose were instituted. The case was heard in the circuit court of the United States for the western district of Pennsylvania in November, 1890, and the value of the work was fixed at $209,000, exclusive of the value of the franchise. The navigation company took an appeal to the Supreme Court of the United States, where the case was argued at the October term, 1892. The judgment of the circuit court was reversed and case remanded, with instructions to grant a new trial. The river and harbor act of August 17, 1894, together with the joint resolution of March 2, 1895, provides for taking testimony as to the value of the improvements of the Monongahela Navigation Company on the Monongahela River in Pennsylvania and the commercial importance of the free navigation of said river, and this is now in progress.

July 1, 1894, balance unexpended	$161,831.77
July 1, 1895, balance unexpended	161,831.77

(See Appendix D D 3.)

4. Purchase of Lock and Dam No. 6, Monongahela River.—An appropriation of $162,000 was made by river and harbor act of September 19, 1890, for acquisition of this structure from the Monongahela Navigation Company, and one of $5,000 for costs of condemnation, after title to Lock and Dam No. 7 shall have been acquired by the United States. As the latter has not yet been obtained, no steps have been taken toward negotiating for Lock and Dam No. 6.

July 1, 1894, balance unexpended	$167,000.00
July 1, 1895, balance unexpended	167,000.00

(See Appendix D D 4.)

5. Locks and dams on Monongahela River.—The river and harbor act of August 17, 1894, authorized and directed the Secretary of War to investigate and report to Congress "at its next succeeding session" the sum of money necessary to acquire by purchase the locks and dams on the Monongahela River, belonging to the Monongahela Navigation Company, and also to take testimony as to the value of said improvements and the commercial importance of the free navigation of said river. To carry out this provision of the act, the Chief of Engineers recommended, September 6, 1894, that the Monongahela Navigation Company be required to submit to the Secretary of War, on or before November 1, 1894, written testimony as to the value of its property, and that this testimony be taken under oath in the presence of Maj. R. L. Hoxie, Corps of Engineers, at Pittsburg, Pa. The attorney for the company having requested permission to submit some views on the subject before investigation was commenced, action on the recommendation of the Chief of Engineers was delayed, and under date of January 15, 1895, the attorney submitted a communication to the Secretary of War stating that the property of the company was not for sale, and that the company was not disposed to enter into any negotiation with the United States looking to a sale thereof.

In view of this declination of the company to sell its property it seemed useless to pursue the investigation authorized by the act, and accordingly a report was made by the Chief of Engineers January 21, 1895, which report was transmitted to Congress and printed as House Ex. Doc. No. 249, Fifty-third Congress, third session.

A joint resolution of Congress, approved March 2, 1895, extended the time for taking the testimony regarding the value of this property, and required the Secretary of War to report thereon to Congress at its next regular session in December, 1895. By letter of March 18, 1895, Major

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Hoxie was, by direction of the Secretary of War, instructed to receive testimony on the subject, tendered by the interested parties, such testimony to be given under oath, and to make report at the proper time. The investigation is now in progress.

6. Cheat River, West Virginia.—The channel of this river was originally filled with rock obstructions, which interfered with the free passage of logs, making the transportation of timber from the head waters of this river to the markets along the Monongahela and Ohio rivers very hazardous. The river has been improved by the removal of rocks, and is now in fair condition between Rowlesburg and Green Island, a distance of 20¼ miles. As the appropriation for the improvement was exhausted, no further work was done during the past fiscal year.

The amount expended on this work up to the end of the fiscal year ending June 30, 1894, is $12,993.64.

July 1, 1894, balance unexpended	$6.36
June 30, 1895, amount expended during fiscal year	3.20
July 1, 1895, balance unexpended	3.16

(See Appendix D D 5.)

7. Allegheny River, Pennsylvania.—The original condition of the Allegheny River as to depth, width, and navigability can not be definitely stated from existing records, both the low-water line and the elevation of the river bed being variable. The approved project for the improvement of the river is the removal of obstructions from the channel and the construction of low dams to close double channels, and of dikes to confine the waterway where the river is too wide. Much benefit to navigation has resulted. During the past fiscal year Dike No. 1, at Cowanshannock, was completed, and repairs made to dam and abutment at Tionesta of injuries caused by heavy scour at that place. Obstructions were removed from the channel aggregating 6,645 tons of rock and 72 snags. The dikes proposed at Cowanshannock being somewhat novel in design, it was thought best during the past working season to construct only one of these and subject it to a practical test of the winter ice. It has not yet been possible to make a critical examination of this dike, but it is believed that it has sustained no serious injury, and the other dikes of a similar type planned for the same locality will be put in as soon as a good working stage of the river permits.

The amount expended on this work up to the close of the fiscal year ending June 30, 1894, is $190,787.52.

July 1, 1894, balance unexpended	$14,212.48
Amount appropriated by act of August 17, 1894	12,500.00
	26,712.48
June 30, 1895, amount expended during fiscal year	7,133.06
July 1, 1895, balance unexpended	19,579.42
July 1, 1895, outstanding liabilities	17.12
July 1, 1895, balance available	19,562.30
Amount that can be profitably expended in fiscal year ending June 30, 1897. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	12,500.00

(See Appendix D D 6.)

8. Dam at Herr Island, Allegheny River, near Pittsburg, Pa.—The object of this dam is to begin a system of slack-water navigation and enlarge the harbor room at Pittsburg to the extent of the pool formed by the dam. The original project was for a fixed dam, but in compli-

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ance with the request of the authorities of Pittsburg and Allegheny City the Secretary of War has ordered that the dam at Herr Island be made a movable one. Delay was caused by suits brought by the riparian owners, but a change of location such that a waterway for landings 55 feet in width is left between the inner wall of the lock and the river bank satisfied the riparian owners, and their opposition was withdrawn. The land necessary for the lock and dam has been acquired, and all legal questions as to damages to adjoining property settled. The cofferdam inclosing the site for the lock has been completed, and the greater part of the necessary plant for the construction of the lock and dam has been purchased and received at the work. Temporary buildings have been completed for shops, storehouses, and office. The plans for this work were approved July 10, 1894, and the pumping out of the cofferdam attempted August 27, 1894, but failed, though three 12-inch centrifugal pumps were run at full capacity with a moderate lift. Under modified plans the work of dredging for foundations was completed, and a few piles driven for the concrete forms of the foundation walls, when the advent of high water put a stop to operations. Operations were suspended on February 10, 1895. An unusually severe winter caused but little damage. Work was resumed April 1, 1895, as soon as the water was low enough, injuries repaired, and the setting up of the forms for the concrete foundations commenced. This work is now in progress.

The amount expended on this work up to the close of the fiscal year ending June 30, 1894, is $68,757.41.

July 1, 1894, balance unexpended		$78,742.59
Amount appropriated by act of August 17, 1894		40,000.00
		118,742.59
June 30, 1895, amount expended during fiscal year		38,333.78
July 1, 1895, balance unexpended		80,408.81
July 1, 1895, outstanding liabilities	$6,766.16	
July 1, 1895, amount covered by uncompleted contracts	18,256.85	
		25,023.01
July 1, 1895, balance available		55,385.80
Amount (estimated) required for completion of existing project		444,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		100,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix D D 7.)

EXAMINATION MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examination required by the act of August 17, 1894, was made by the local engineer, Maj. R. L. Hoxie, Corps of Engineers, and report thereon submitted through the division engineer, Col. O. M. Poe, Corps of Engineers.

1. *Preliminary examination of Tionesta River (Creek), Pennsylvania.*—Major Hoxie submitted report of examination September 18, 1894. In his opinion the locality is worthy of improvement by the General Government, but the division engineer states that he is unable to concur in the conclusions of Major Hoxie, and he is therefore compelled to report an adverse opinion.

Concurring in the views of the division engineer, it is the opinion of this office that Tionesta Creek is not worthy of improvement by the

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General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 81, Fifty-third Congress, third session. (See also Appendix D D 8.)

Major Hoxie was also charged with the duty of making preliminary examination of Clarion River, Pennsylvania, and survey of Allegheny River, Pennsylvania, for lock and dam at or near Tarentum, and lock and dam at the most practicable point for navigation between the proposed dam at Tarentum and Herr Island Dam.

The reports of this examination and of this survey will be duly submitted when received.

IMPROVEMENT OF FALLS OF OHIO RIVER, OF WABASH RIVER, INDIANA AND ILLINOIS, AND OF WHITE RIVER, INDIANA.

This district was in the charge of Capt. J. G. Warren, Corps of Engineers, with Lieut. Hiram M. Chittenden, Corps of Engineers, under his immediate orders, to November 18, 1894; Division Engineer, Col. O. M. Poe, Corps of Engineers.

1. Falls of the Ohio River at Louisville, Ky.—This work is located at the eastern or upper end of the Louisville and Portland Canal, where the canal had a width of about 100 feet with no facilities for arranging or making up tows when about to enter or leave the canal.

The original project was adopted in 1883, slightly modified in 1885, and revised January 28, 1890, by a Board of Engineer Officers convened for that purpose. The project provides for widening the canal on its northerly side, beginning at a point 725 feet below the Fourteenth-street railroad bridge, where the width of the canal is abruptly increased from 90 feet to 210 feet; this latter width is gradually increased through a distance of nearly 2,800 feet to 325 feet at the head of the canal proper, where the enlargement is expanded into a capacious basin 1,200 feet wide and practically parallel to the Kentucky shore.

At the close of the fiscal year ending June 30, 1894, $719,733.58, which amount includes $161.01 outstanding liabilities and $133,000 expended for enlarging the basin above the locks, had been expended for work done under the projects.

With the exception of a small portion at high water, the enlargement is not available for the purposes of commerce on account of its incomplete state. This work of improvement, of unquestionable importance, has now been in progress for more than ten years, yet owing to irregular and insufficient appropriations, navigation has not, up to the present, received any appreciable benefit from the work accomplished. As has been stated in previous Annual Reports, the cost of the work must be greatly increased by executing it under small appropriations. The nature of the area under improvement renders it imperative to remove every vestige of plant during the high-water period, and the percentage of cost for this transfer of plant to and from storage is inordinately increased where full advantage can not be taken of an exceptionally favorable season for prosecuting the work.

Expenditures during the fiscal year ending June 30, 1895, amounted to $57,566.97, not including the outstanding liabilities on that date, amounting to $278.19. The money was applied to furthering progress on portions of the work, but, as stated above, little advantage will be realized until the entire work has been completed. The following is a summary of operations during the year: 7,467 cubic yards stone removed from the old north canal wall, transferred to south side of the canal, and piled for future use; 1,032 cubic yards masonry placed in the new wall,

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thus filling the gaps above Fourteenth Street Bridge, and adding considerably to the still unfinished portion below that point; construction of a crib dam 750 feet long, for which 202,349 feet, B. M., lumber and 5,500 cubic yards stone filling were used; excavation and removal of 43,724 cubic yards of earth; drilling, blasting, and breaking up, but not removing, 5,192 cubic yards solid rock; repairs to guiding dike, for which 10,000 feet, B. M., lumber was used, and building a storehouse for the tools and appliances.

July 1, 1894, balance unexpended	$427.43
Amount appropriated by act of August 17, 1894	60,000.00
	60,427.43
June 30, 1895, amount expended during fiscal year	57,566.97
July 1, 1895, balance unexpended	2,860.46
July 1, 1895, outstanding liabilities	278.19
July 1, 1895, balance available	2,582.27
Amount (estimated) required for completion of existing project	490,008.89
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	60,000.00

(See Appendix E E 1.)

2. Indiana Chute, Falls of the Ohio River.—This main channel of the river over the Falls of the Ohio was originally very crooked, with irregular rock projecting from the sides and bottom, and was only safe for navigation during high stages of water.

No general project was adopted until January 31, 1890, although before that date much work had been done, resulting in material benefit to navigation. The project of 1890 provides for specific improvements within certain limits by rock excavation and construction of dikes and dams, so as to render this chute available for descending traffic when the river is at or above a stage of 8 feet, upper canal gauge.

As yet the work is in an incomplete state, although much progress has been made and portions of the channel greatly improved. It is thought that with sufficient funds and favorable conditions the work outlined by the project could be practically completed within one good working season. When completed the improvement will be an advantage of great importance, especially to the heavy coal traffic, which would then follow the route through this chute, as shipments of coal when the river is at a lower stage than 8 feet are exceedingly small.

The total of expenditures for work done to June 30, 1894, was $197,456.06, including outstanding liabilities on that date; of this amount $116,070.30 was expended before the adoption of the present project and $81,385.76 since. Expenditures for operations during the present fiscal year amount to $19,773.30, including outstanding liabilities June 30, 1895, and were applied to the excavation of rock from the 400-foot channel above the railroad bridge, repairs to the cross dam, for which 63,000 feet, B. M., lumber was used, repairs to the movable dam, and, jointly with the work at the head of the canal, in the construction of a house for storing tools and appliances.

This chute is but a part of the Falls, and it is equally necessary that work be done at other points, as between this work and that at the head of the canal there is no practical line of division. The object of both is to facilitate the movement of boats past the same obstacle at stages of the river most favorable to shipment, and if the funds be made available without providing for their application at specific points

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small appropriations could be consolidated and applied to the completion of some portion of the improvement whereby its advantages could be realized by the interests they were designed to benefit.

July 1, 1894, balance unexpended	$2,662.14
Amount appropriated by act of August 17, 1894	20,000.00
	22,662.14
June 30, 1895, amount expended during fiscal year	19,512.42
July 1, 1895, balance unexpended	3,149.72
July 1, 1895, outstanding liabilities	260.88
July 1, 1895, balance available	2,888.84
Amount (estimated) required for completion of existing project	37,250.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix E E 2.)

3. Operating and care of Louisville and Portland Canal, Kentucky.—Navigation through the canal was possible throughout the year, except thirty-five days, when it was prevented by ice and high water. The canal is available for the passage of boats until the water reaches a stage of 12.7 feet, when the lock gates can no longer be operated. There are two chambers to the new locks, each being 350 feet long and 80 feet wide.

The present work is the outgrowth of the construction of the canal by a private corporation and its transfer to the United States by authority of Congress in 1874. Since then the canal and locks have been enlarged or improved in several respects. The annual projects have always contemplated operating the canal and keeping it in repair, together with such special work as may from time to time be found necessary to make it sufficient to meet the demands of navigation.

Expenditures since July, 1880, when tolls were abolished and the canal became a direct charge on the Treasury, amount to $950,329.74 to June 30, 1894.

The canal generally is in good condition, and serves its purposes by permitting free navigation around the Falls of the Ohio River at stages of water when the passage can not be made by the open river channel. During the present fiscal year 3,955 boats and 730,656 tons of freight passed through the canal.

Expenditures during the present year have been, besides those for ordinary operating expenses, for building six new lock engine houses of Cloverport sandstone, excavating channel below locks, rebuilding old north wall, retaining wall near dry dock, brick pavement above new locks, sodding slopes, and work of a like nature, having in view the object of making all parts of the work permanent in character.

The cost of operating and care of the canal during the year amounts to $119,160.28, including outstanding liabilities June 30, 1895.

(See Appendix E E 3.)

4. Wabash River, Indiana and Illinois.—In its original condition this river was badly obstructed with shoal bars, accumulation of snags, rock reefs, numerous secondary channels or cut-offs, lessening the flow of water through the main channel.

The original project is that submitted by Maj. G. Weitzel in 1872, providing for special improvement at twelve designated points and a general improvement of the whole river from its mouth to La Fayette, Ind., by means of light-draft snag boats and dredges. Until March 3,

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1881, appropriations were applicable to this whole reach of river. The act of Congress of that date separated the river into two sections, with Vincennes, Ind., as the dividing point, and since then specific appropriations have been made for each section.

From the time when improvements were commenced until March 31, 1881, expenditures amounted to $324,845.44; since the latter date the expenditures for each section are given below separately.

a. Below Vincennes.—Since March 31, 1881, and to June 30, 1894, expenditures for work below Vincennes amount to $314,924.96, including liabilities outstanding on that date.

Since 1884 the greater portions of appropriations have been applied to building a lock and dam at Grand Rapids, which are now practically completed, except the leading dikes to the lock, which latter is available for use. On other parts of the river where work has been suspended most of the structures have decayed and been swept away by floods and ice, or the river cut around them, thereby causing them to form, in some instances, worse obstructions than those they were designed to overcome. The channels have become choked with snags and bowlders, and bars formed, rendering navigation, except at high water, impossible, and even then dangerous.

Expenditures during the present fiscal year were for completing the dam at Grand Rapids and replacing a portion which was torn out by the ice during January, 1895. This dam is now completed, except the gravel filling to be placed on the up-stream side. Some excavation work for the leading dikes was also done. Expenditures during the year amount to $10,215.40, including outstanding liabilities June 30, 1895.

July 1, 1894, balance unexpended	$309.60
Amount appropriated by act of August 17, 1894	15,000.00
	15,309.60
June 30, 1895, amount expended during fiscal year	8,690.34
July 1, 1895, balance unexpended	6,619.26
July 1, 1895, outstanding liabilities	1,525.06
July 1, 1895, balance available	5,094.20
Amount (estimated) required for completion of existing project	25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	14,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

b. Above Vincennes.—Since this part of the river became the object of specific appropriations the sum of $79,949.52 was expended to June 30, 1894.

Formerly a fairly good channel of 3 feet in depth was maintained, but in later years appropriations have been too small to admit of much else besides snagging operations at such times as the snag boat was not in use elsewhere. Since then the brush dams have been torn away by high water and shoals have formed, leaving the river in a very unsatisfactory condition.

During the present year no operations have been in progress. The snag boat *Osseo*, being engaged elsewhere, was not available for use on this portion of the river at times when the work of snagging was practicable.

Expenditures for the maintenance and care of plant and office work amount to $1,644.04, including outstanding liabilities June 30, 1895.

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July 1, 1894, balance unexpended	$550.48
Amount appropriated by act of August 17, 1894	5,000.00
	5,550.48
June 30, 1895, amount expended during fiscal year	1,637.19
July 1, 1895, balance unexpended	3,913.29
July 1, 1895, outstanding liabilities	6.85
July 1, 1895, balance available	3,906.44
Amount (estimated) required for completion of existing project	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	6,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix E E 4.)

5. White River, Indiana.—This river in its original condition was badly obstructed by snags, rocky reefs, shoals, remains of old structures, and only available for navigation by small boats at high stages of water, and even then dangerous.

The original project was adopted in 1879, providing for improving Kellys Ripple, rock excavation at other ripples and shoal places, removing bar, snags, and piers of old aqueduct, confining channel for removal of bars and protection of banks, and removing snags, at an estimated cost of $150,000.

Expenditures to June 30, 1894, amounted to $110,587.18, including outstanding liabilities on that date.

With sufficient funds a navigable low-water channel might be realized, but for several years the money available has permitted but little other work than snagging, and only a limited amount of this. In the meantime the old structures have decayed and been torn away, channels choked, and snags accumulated. The original estimate contemplated sufficient funds to carry on the work continuously, and the report of December 27, 1878, states that $1,000 per mile would be a low estimate for the removal of snags from some portions of the river.

Expenditures during the present year were for the removal of snags from a portion of the river known as Seven Mile Bend, and amounted to $3,151.87.

July 1, 1894, balance unexpended	$2,982.32
Amount appropriated by act of August 17, 1894	5,000.00
	7,982.32
June 30, 1895, amount expended during fiscal year	3,151.87
July 1, 1895, balance unexpended	4,830.45
Amount (estimated) required for completion of existing project	2,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	2,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix E E 5.)

IMPROVEMENT OF GREAT KANAWHA, ELK, AND GAULEY RIVERS, WEST VIRGINIA, AND OF NEW RIVER, VIRGINIA AND WEST VIRGINIA

This district was in the charge of Col. (now Brig. Gen.) William P. Craighill, Corps of Engineers, to May 18, 1895, and of Lieut. Col. Peter C. Hains, Corps of Engineers, since that date.

1. Great Kanawha River, West Virginia.—This river flows through a fertile and picturesque region, filled with mineral wealth, especially

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coal and salt. It was by nature divided into a number of pools, some of considerable length and depth, separated by shoals of gravel and coarse sand, which were the principal obstructions to navigation in low water, there being often on them at such seasons but a few inches of water. In some of the pools were found shallow places, also obstructing navigation. There were also snags and loose rocks in the channel. The navigation was almost suspended in summer.

The coal and salt were generally sent out on rises, which enabled the boats to pass safely over the obstructions that otherwise would stop their movements entirely. The use of the river for the movement of these valuable products was therefore unsatisfactory and intermittent. By the agency and superintendence of a board acting under the State, first of Virginia and then of West Virginia, considerable improvement in the river was from time to time effected, tolls being charged on the commerce for the payment of expenses.

The object of the improvement, begun several years ago by the United States, was to give a constant navigable depth of at least 6 feet throughout the whole length of the Kanawha to its mouth at the Ohio River, to be accomplished by large locks and dams.

Those already built have been about 300 by 50 feet above Charleston and about 340 by 55 feet below.

The peculiarity of most of the dams is that they can be lowered when the stage of the water in the river will suffice over the shoals. This gives them the name of "movable dams," and enables an open river to be had when the water is high enough.

Dams 3 and 2, above Paint Creek, are fixed, as the declivity of the river in that section is too great to permit the advantageous use of the movable system.

Up to June 30, 1894, the amount expended was $2,845,575.34. At that date the finished works were Locks and Dams 2, 3, 4, 5, 6, 7, and 8. Contracts had also been made for 9, 10, and 11.

The following list of contracts indicates in a summary way the principal works in progress during the fiscal year:

Contract with Zimmerman, Truax & Sheridan, dated May 23, 1893, for building Lock and Dam No. 9, to be completed December 31, 1896.

Contract with Thomas Munford, dated June 1, 1893, for building Lock and Dam No. 11, to be completed December 31, 1896.

Contract with Zimmerman, Truax & Sheridan, dated June 5, 1893, for building Lock and Dam No. 10, to be completed December 31, 1896.

Contract with the Van Dorn Iron Works Company, dated June 8, 1894, for ironwork for Locks 9, 10, and 11, completed December 10, 1894.

Contract with the Youngstown Bridge Company, dated October 5, 1894, for ironwork for Dams 9, 10, and 11, to be completed March 1, 1896.

Contract with David Eagan, dated June 10, 1895, for building five houses for lock hands at Locks Nos. 7 and 8, to be completed November 12, 1895.

The amount expended in the year ending June 30, 1895, was $273,270.85.

Had funds been available all the locks and dams needed for this improvement could have been begun at the same time and finished in three years with much economy to the United States and with manifest advantage in the use of the improved waterway. The development of commerce on this river has been very great since the improvement by the United States, although the project has as yet been only partially executed for want of money.

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During the seasons of low water the value of the improvement is shown in a very marked manner, as free and sufficient navigation is then easily maintained over the improved part of the river, while navigation may be entirely suspended below the lowest dam and above the upper pool.

July 1, 1894, balance unexpended		$476,626.71
Amount appropriated by sundry civil act approved March 2, 1895		580,700.00
		1,057,326.71
June 30, 1895, amount expended during fiscal year		273,270.85
July 1, 1895, balance unexpended		784,055.86
July 1, 1895, outstanding liabilities	$4,000.00	
July 1, 1895, amount covered by uncompleted contracts	640,301.86	
		644,301.86
July 1, 1895, balance available		139,754.00

(See Appendix F F 1.)

2. Operating and care of locks and dams on Great Kanawha River, West Virginia.—The amount expended during the fiscal year ending June 30, 1895, for this purpose was $29,983.04.

(See Appendix F F 2.)

3. Elk River, West Virginia.—The Elk is one of the chief tributaries of the Great Kanawha, emptying into it at Charleston. Its course is tortuous, but the country through which it flows is rich in minerals and well fitted for agriculture and grazing.

An application was made February 12, 1894, by the county court of Kanawha County, W. Va., to build a bridge across the river at Clendenin, W. Va. Some modifications were suggested by the local engineer. The necessary authority has been given by the Secretary of War, and the bridge was completed June 18, 1895.

There were no operations in the year ending June 30, 1895.

July 1, 1894, balance unexpended	$79.01
Amount appropriated by act of August 17, 1894	2,000.00
	2,079.01
June 30, 1895, amount expended during fiscal year	180.45
July 1, 1895, balance unexpended	1,898.56

(See Appendix F F 3.)

4. Gauley River, West Virginia.—Gauley River takes its rise in Webster County, W. Va., its tributaries having their sources in Pocahontas and Greenbrier counties. It is about 115 miles in length, flowing through Nicholas and Fayette counties in a southwesterly direction, sometimes nearly west, and near its mouth almost due south; it is entirely in the State of West Virginia. Its head waters and those of its tributaries are covered with a virgin forest of the finest timber, with only clearings of a few acres here and there; and on the north side of the river, in Webster and Nicholas counties, some glades a few miles wide and in extent 20 or 25 miles, which give only a stunted growth, to break up this vast timber section.

For the first 12 miles from its mouth the Gauley falls only 4 feet per mile; in the next 26 miles its fall is nearly 34 feet per mile, in a gorge similar to that of New River, as seen from the Chesapeake and Ohio Railway between Kanawha Falls and Hinton, the hills on either side being several hundred feet high and almost perpendicular, and the stream full of bowlders of sandstone, some very large and so numerous

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as to justify the people in calling this section the "Roughs" of Gauley. From the head of the "Roughs" near Hominy Creek, 2 miles above Hughes Ferry, to the Forks, about 57 miles, the fall is estimated at 5 feet per mile. The levels from the mouth of Gauley River to the mouth of Meadow River, 29 miles, are taken from Ellet's report on the Great Kanawha River, West Virginia, made in 1858; the remainder are estimated. The levels on Meadow River were obtained from the same source.

Gauley River is 500 feet wide at its mouth, 350 feet wide at the mouth of Meadow River, 200 feet wide at the mouth of Cranberry River, 150 feet wide at the mouth of Williams River, and 75 feet wide at the Forks.

Operations for the improvement of the Gauley River were instituted after an examination made in 1888, in accordance with the provisions of the river and harbor act of August 5, 1886. It was then pointed out that a valuable improvement of the 12 miles of river from the mouth to the "Roughs" could be made at an expense of $10,000, and that a great advantage would follow the expenditure of $65,000 in the 26-mile reach called the "Roughs" in facilitating and cheapening the bringing to market of millions of feet of lumber of the most valuable and varied kinds.

The approved project has consisted in the removal of ledges and loose rocks and the making of channels through the shoals of loose rock and bowlders from the mouth of the river to the "Roughs" to improve the navigation for boats and rafts, and in blasting down the very large bowlders in the "Roughs" to permit the more free passage of logs. The amount expended to the close of the fiscal year ending June 30, 1894, was $8,804.58, with decided advantage to the navigation over the worst shoals below the "Roughs."

The amount expended in the fiscal year ending June 30, 1895, has been $1,931.05.

Work under the appropriation of $3,000, August 17, 1894, was commenced in September, 1894, and closed the last of October. The portion of the river included in the operations was from the mouth, through a portion of the "Roughs," to a point 14⅞ miles above the mouth. Its navigable condition has been thereby decidedly improved to obtain a depth of 2 feet at ordinary low water.

The balance of funds available did not justify resuming operations in the summer of 1895.

July 1, 1894, balance unexpended	$15.42
Amount appropriated by act of August 17, 1894	3,000.00
	3,015.42
June 30, 1895, amount expended during fiscal year	1,931.05
July 1, 1895, balance unexpended	1,084.37
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	63,000.00

(See Appendix F F 4.)

5. *New River, Virginia and West Virginia.*—The last appropriation was that of August 5, 1886, of which a balance remains of $2,308.94.

In compliance with a recommendation of the local engineer, it was decided by the Secretary of War not to expend the existing balance at present.

There were no operations in the year ending June 30, 1895.

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The Chesapeake and Ohio Railway has constructed a bridge over the unnavigable portion of this river, not far above its junction with the Gauley.

July 1, 1894, balance unexpended	$2,341.79
June 30, 1895, amount expended during fiscal year	32.85
July 1, 1895, balance unexpended	$2,308.94

(See Appendix F F 5.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations of the following localities, required by the act of August 17, 1894, were made by the local engineer, Col. William P. Craighill, Corps of Engineers, and reports thereon submitted:

1. Preliminary examination of Big Coal and Little Coal rivers, West Virginia.—Colonel Craighill submitted report of examination September 29, 1894. In his opinion, concurred in by this office, these rivers are not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 82, Fifty-third Congress, third session. (See also Appendix F F 6.)

2. Preliminary examination of Elk River, West Virginia, with a view of locking and damming same.—Colonel Craighill submitted report of examination November 5, 1894. In his opinion, concurred in by this office, the improvement of Elk River by locks and dams is not such as to be worthy to be undertaken by the United States at this time. The report was transmitted to Congress and printed in House Ex. Doc. No. 67, Fifty-third Congress, third session. (See also Appendix F F 7.)

IMPROVEMENT OF CERTAIN RIVERS IN KENTUCKY AND WEST VIRGINIA.

This district was in the charge of Maj. D. W. Lockwood, Corps of Engineers, having under his immediate orders Capt. H. E. Waterman and Lieut. James J. Meyler, Corps of Engineers; Division Engineer, Col. O. M. Poe, Corps of Engineers.

1. Tradewater River, Kentucky.—This river, before the work of improvement commenced, was practically closed by a rock bar near its mouth, and higher up by logs, snags, drift piles, leaning trees, and bars.

The present project, adopted in 1881, provides for clearing the river and its banks of obstructions, and opening up a channel 40 feet wide and 2½ feet deep during six months of the year, the improvement to extend 41 miles upstream from its mouth in the Ohio.

Up to June 30, 1894, $15,738.65 had been expended, resulting in securing a channel through the rock bar near the mouth of the river, and in removing obstructions in the channel and on the banks of the river for a distance of 41 miles, the distance covered by the present project.

The amount expended during the fiscal year ending June 30, 1895, was $24, in purchase of stationery and care of property.

July 1, 1894, balance unexpended	$761.35
June 30, 1895, amount expended during fiscal year	24.00
July 1, 1895, balance unexpended	737.35
July 1, 1895, outstanding liabilities	18.00
July 1, 1895, balance available	719.35

(See Appendix G G 1.)

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2. Lock No. 2, Green River, at Rumsey, Ky.—The deficiency act approved March 3, 1893, appropriated $65,000 for rebuilding this lock, which in 1892 was reported unsafe for navigation.

The project for this work, approved in 1893, calls for the construction of a new lock on the river side of the old lock, with certain changes of existing conditions to make them conform to location of lock.

The amount expended to June 30, 1894, was $35,940.53, and resulted in the completion of auxiliary dam, the construction of cofferdam surrounding part of lock site, excavation of rock inside coffer, and partial construction of head of lock. The work was much hindered and delayed by the failure of stone contractors to furnish stone.

The amount expended during the fiscal year ending June 30, 1895, was $28,698.34, and resulted in completing cofferdam inclosing site of lock and excavation for same.

July 1, 1894, balance unexpended		$29,059.47
Amount appropriated by act of August 17, 1894		105,000.00
		134,059.47
June 30, 1895, amount expended during fiscal year		28,698.34
July 1, 1895, balance unexpended		105,361.13
July 1, 1895, outstanding liabilities	$7,383.99	
July 1, 1895, amount covered by uncompleted contracts	32,120.00	
		39,503.99
July 1, 1895, balance available		65,857.14

(See Appendix G G 2.)

3. Green River above mouth of Big Barren River, Kentucky.—In pursuance of the provisions of act of September 19, 1890, an examination was made of this portion of Green River, and the report thereon, with project for the work proposed, was submitted to Congress as Appendix J J 15, Annual Report of Chief of Engineers, 1891.

The improvement proposed contemplated the construction of two locks and dams, so as to extend slack-water navigation to Mammoth Cave, at an estimated cost of $361,346.40.

The river and harbor act of July 13, 1892, appropriated $50,000 toward the construction of Lock No. 5, the project for which provides for the location and construction of a lock and dam at the head of slack-water navigation on the river.

The amount expended to June 30, 1894, was $2,568.30, in examinations and surveys for location of Lock No. 5.

The amount expended during the fiscal year ending June 30, 1895, was $501.56, in surveys and borings, paying expenses of Board of Engineer Officers to determine location, and in making abstracts to fix title.

July 1, 1894, balance unexpended	$47,431.70
Amount appropriated by act of August 17, 1894	25,000.00
	72,431.70
June 30, 1895, amount expended during fiscal year	501.56
July 1, 1895, balance unexpended	71,930.14
July 1, 1895, outstanding liabilities	2,173.95
July 1, 1895, balance available	69,756.19
Amount (estimated) required for completion of existing project	105,673.20
Amount that can be profitably expended in fiscal year ending June 30, 1897	25,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix G G 3.)

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4. Operating and care of locks and dams on Green and Barren rivers, Kentucky.—When the United States acquired possession of these improvements, December 11, 1888, navigation of the system was broken at Lock No. 3, Green River, the river wall of that lock having fallen into the river; the lower end of the land wall at No. 1, Barren River, was badly cracked and liable to fall at any time, and both walls of No. 2, Green River, were in a dangerous condition.

The channel of the river was much obstructed by snags and slides.

The operations up to June 30, 1894, resulted in the rebuilding of the old river wall at Lock No. 3; the taking down and reconstruction of the lower half of the river wall at No. 1, Barren; the rebuilding of Dams Nos. 1, 3, and 4, Green River, and No. 1, Barren; grading and paving behind the lock walls at the different locks, with the exception of No. 2, Green, and the building of seven lock keepers' houses; also in the construction of a snag boat, dredge boat, and various barges and derrick boats required in the prosecution of the work.

The amount expended during the fiscal year ending June 30, 1895, was $42,315.42, in general repairs to locks, dams, operating of snag boat engaged in pulling snags and towing, operating of dredge boat engaged in cleaning out lock pits and entrances, building and placing new upper gates at Lock No. 1, and in minor repairs to buildings, etc.

(See Appendix G G 4.)

5. Rough River, Kentucky.—This river was originally very much obstructed by overhanging trees on the banks and by snags, logs, etc., in the bed of the river. The lower 8 miles of the stream are affected by backwater from the Rumsey Dam (No. 2) on Green River, but above this point the stream has but little depth at low water.

The project for the improvement, adopted in 1890, is to clear the river of obstructions, to wit, overhanging trees on the banks, and snags, logs, and stumps in the bed of the river, and to locate and construct a lock and dam near the site of the old ones to carry slack water to Hartford.

The amount expended to June 30, 1894, was $7,490.28, and resulted in the removal of snags from the bed of the river from its mouth to Hartford, the deadening of trees on banks for the same distance, surveys of site and obtaining title to land, preparation of plans and estimates, etc.

The amount expended during the fiscal year ending June 30, 1895, was $5,005.20, and resulted in clearing timber from the banks from the mouth of the stream to the site of the lock, and in preparing site for cofferdam inclosing the lock, construction of temporary buildings, trestles, tramways, etc.

July 1, 1894, balance unexpended	$32,509.72
Amount appropriated by act of August 17, 1894	22,500.00
	55,009.72
June 30, 1895, amount expended during fiscal year	5,005.20
July 1, 1895, balance unexpended	50,004.52
July 1, 1895, outstanding liabilities	11,248.04
July 1, 1895, balance available	38,756.48
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	43,056.00

(See Appendix G G 5.)

6. Kentucky River, Kentucky.—When the United States assumed charge of the improvement of this river the five locks and dams, with their approaches, built by the State of Kentucky, were in a dilapidated

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condition, and the channel was much obstructed by snags and leaning trees.

The project for the improvement, adopted in 1879, called for the necessary repairs to the five locks and dams and the extension of slack-water navigation for a draft of 6 feet by the construction of additional locks and dams to Beattyville, a distance of 261 miles from the mouth of the river.

The amount expended to June 30, 1894, was $1,431,121.78, resulting in restoring navigation to Oregon, a distance of 99 miles from the Ohio, and extending same to High Bridge, Ky. This required the construction of some new dams, practically rebuilding others, the construction of new abutments and extensive guide and retaining walls, the replacing of old miter walls and sills with new ones, and the construction and placing of new gates, the building of a new lock and dam (No. 6), the construction of a new towboat, and in the purchase of tools, plant, and operating machinery.

The amount expended during the fiscal year ending June 30, 1895, was $7,319.62, and resulted in the completion of lock houses and auxiliary works at Lock No. 6, and the running of a line of levels from Lock No. 6 to a point above Hickman, Ky. Examinations and surveys were also made for locating Lock No. 7.

July 1, 1894, balance unexpended	$66,878.22
Amount appropriated by act of August 17, 1894	125,000.00
	191,878.22
June 30, 1895, amount expended during fiscal year	7,319.62
July 1, 1895, balance unexpended	184,558.60
July 1, 1895, outstanding liabilities	1,528.32
July 1, 1895, balance available	183,030.28
Amount (estimated) required for completion of existing project	1,399,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix G G 6.)

7. Operating and care of locks and dams on Kentucky River, Kentucky.—The first allotment for this work was for the fiscal year ending June 30, 1885, at which time only four locks could be operated. These required extensive repairs at the time, and the dams and approaches were in a more or less dilapidated condition.

The operations up to June 30, 1894, resulted in reopening Lock No. 5 to navigation and placing the other locks and dams in a serviceable condition, the building of guide walls, approaches, the construction of one double and seven single lock houses, and in grading, paving, and draining grounds about the locks. A new dredge boat, of the Osgood pattern, and two dump scows have been constructed, and general repairs made to locks, dams, etc., and, in addition, the river has been kept clear of snags. A stone abutment to Dam No. 2 has been constructed, and the lock entrances kept clear by dredging.

The amount expended during the fiscal year ending June 30, 1895, was $41,756.96, and resulted in keeping the river free from snags and other obstructions, dredging lock pits and entrances and shoals below Locks Nos. 4 and 6, raising upper miter wall and putting in new miter sill at Lock No. 3, and new lower gates at same lock. New sheeting was put on some of the dams, and minor repairs made wherever needed.

(See Appendix G G 7.)

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8. Licking River, Kentucky, between Farmers and West Liberty.—This stream was originally much obstructed by logs, snags, rocks, and leaning trees, as well as by fish dams constructed by private parties.

The project for the improvement was adopted in 1888, and provides for removing rocks, snags, and bowlders from the river bed.

The amount expended to June 30, 1894, was $6,000, and resulted in the removal from the bed of the river of a large number of rocks, snags, etc., that obstructed both rafting and low-water navigation.

No money was available during the fiscal year ending June 30, 1895.

Amount (estimated) required for completion of existing project..... $11,680.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.

(See Appendix G G 8.)

9. Big Sandy River, West Virginia and Kentucky.—When the United States commenced improving this stream it and its forks were much obstructed by rocks, bars, snags, and leaning trees. During low-water seasons navigation was practically suspended.

The original project for improvement was adopted in 1878, and provided for improving the push-boat and rafting facilities of the river and forks by removing obstructions, etc. This was modified in 1880 to secure slack-water navigation by the construction of a test lock and fixed dam, near Louisa, Ky.

At the close of the fiscal year ending June 30, 1891, the lock and the abutment had been completed and about 80 feet of the permanent dam built, but owing to protests against a fixed dam by the timber interests, a Board of Officers of the Corps of Engineers was convened "to consider and report upon the subject of the dam," etc., and in its report dated November 10, 1891, the Board recommended the substitution of a needle dam for a fixed dam. This change of project was approved by the Chief of Engineers November 20, 1891.

The amount expended to June 30, 1894, was $308,849.60, and resulted in improving low-water navigation by the removal of logs, stumps, snags, trees, and other obstructions from the bed of the river, the construction of a lock 185 feet long between hollow quoins and 52 feet wide, and in the construction of masonry of pass and part of pier for needle dam.

The amount expended during the fiscal year ending June 30, 1895, was $20,358.87, and resulted in the completion of the masonry foundation of needle dam, pier, and abutment, grading of banks on both sides of river, and in riprapping and paving same. The old waste piles in bed of river were removed, and the foundation is now ready to receive trestles of needle dam.

July 1, 1894, balance unexpended	$1,150.40
Amount appropriated by act of August 17, 1894	40,000.00
	41,150.40
June 30, 1895, amount expended during fiscal year	20,358.87
July 1, 1895, balance unexpended	20,791.53
July 1, 1895, outstanding liabilities	2,536.86
July 1, 1895, balance available	18,254.67

Amount (estimated) required for completion of existing project..... 30,151.58
Amount that can be profitably expended in fiscal year ending June 30, 1897 30,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix G G 9.)

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10. Levisa Fork of Big Sandy River, Kentucky.—This stream was originally much obstructed by rocks, snags, logs, and overhanging trees. Its improvement has been in progress since work on the Big Sandy was commenced under the project for the improvement of that stream.

The present project was adopted in 1890, and provides for the removal of snags, logs, stumps, rocks, etc., from the river and overhanging trees on the banks.

The amount expended to June 30, 1894, was $23,185.92, and resulted in the material improvement of navigation by the removal of obstructions, giving increased facilities for push-boat navigation at low water, and rafting and light-draft steamboat navigation at moderate stages.

The amount expended during the fiscal year ending June 30, 1895, was $1,421.88, expended in removing logs, snags, trees, etc., brought into the stream by the high water of previous winter and spring.

July 1, 1894, balance unexpended	$64.08
Amount appropriated by act of August 17, 1894	2,500.00
	2,564.08
June 30, 1895, amount expended during fiscal year	1,421.88
July 1, 1895, balance unexpended	1,142.20
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	1,000.00

(See Appendix G G 10.)

11. Tug Fork of Big Sandy River, West Virginia and Kentucky.—This stream was originally much obstructed by rocks, snags, logs, and overhanging trees. Its improvement has been in progress since work on the Big Sandy was commenced on the project for the improvement of that stream.

The present project was adopted in 1890, and provides for the removal of snags, logs, stumps, rocks, etc., from the river, and overhanging trees from the banks.

The amount expended to June 30, 1894, was $23,213.36, and has resulted in the material improvement of navigation, giving increased facilities for push boats at low water, and rafting and light-draft steamboats at moderate stages.

The improvement has been carried to a point 100 miles above Louisa.

During the fiscal year ending June 30, 1895, $1,495.14 was expended in going over the improved part of the river and removing obstructions that had come into the river from the rises of previous winter and spring, such as logs, snags, trees, etc.

July 1, 1894, balance unexpended	$36.64
Amount appropriated by act of August 17, 1894	2,500.00
	2,536.64
June 30, 1895, amount expended during fiscal year	1,495.14
July 1, 1895, balance unexpended	1,041.50
July 1, 1895, outstanding liabilities	81.08
July 1, 1895, balance available	960.42
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	2,000.00

(See Appendix G G 11.)

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12. Guyandotte River, West Virginia.—This stream was originally much obstructed by snags, logs, leaning trees, the remains of old dams, and milldams owned by private parties, which required removal.

The project for the improvement was adopted in 1878, and provided for the removal of existing obstructions, natural and artificial, so as to form a channel 30 feet wide, with a least depth of 18 inches, during five months of the year, and extending up the river a distance of 122 miles from the Ohio.

Up to the close of the fiscal year ending June 30, 1894, $18,471.72 had been expended, resulting in the partial improvement of the river for a distance of 119 miles, removing snags, logs, etc., from the channel, and cutting passageways through old dams.

During the fiscal year ending June 30, 1895, $58.47 was expended in incidentals.

July 1, 1894, balance unexpended	$28.28
Amount appropriated by act of August 17, 1894	2,000.00
	2,028.28
June 30, 1895, amount expended during fiscal year	58.47
July 1, 1895, balance unexpended	1,969.81
July 1, 1895, outstanding liabilities	1,108.80
July 1, 1895, balance available	861.01
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	1,000.00

(See Appendix G G 12.)

13. Little Kanawha River, West Virginia.—This river, at the time improvements were commenced by the United States, was much obstructed by logs, snags, leaning trees, etc., above that portion controlled by the Little Kanawha Navigation Company.

The original project, adopted in 1876, was for the removal of Beaver and Nailor Bend rocks, and for cleaning out snags and fallen trees. This was modified in 1880 by the adoption of an additional project for the construction of a lock and dam 2 miles above Burning Springs, W. Va.

Up to June 30, 1894, $211,150.12 had been expended, resulting in placing the upper part of the river in a fair rafting condition, and so that, during moderate stages, light-draft steamboats could run as far as Grantsville. The lock and dam 2 miles above Burning Springs have been completed, a lock house built, grounds graded and fenced, and slack-water navigation opened up for an additional distance of 9 miles.

During the fiscal year ending June 30, 1895, $1.60 was expended in incidentals.

July 1, 1894, balance unexpended	$24.88
June 30, 1895, amount expended during fiscal year	1.60
July 1, 1895, balance unexpended	23.28
July 1, 1895, outstanding liabilities	13.07
July 1, 1895, balance available	10.21

(See Appendix G G 13.)

14. Operating and care of lock and dam on Little Kanawha River, West Virginia.—The lock was opened to navigation December 2, 1891, and has been operated continuously, with the exception of a short time in June, 1892, when it was closed temporarily for repairs.

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Owing to the fact that the dams of the Little Kanawha Navigation Company are badly out of repair, the lock is not used for three or four months each year, boats not being able to get up to it.

The amount expended during the fiscal year ending June 30, 1895, was $3,364.13, expended in repairing dam, riprapping banks about abutment, putting new floor in lock pit, and general repairs.

(See Appendix G G 14.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations of the following localities, required by the act of August 17, 1894, were made by the local engineer, Maj. D. W. Lockwood, Corps of Engineers, and reports thereon submitted through the division engineer, Col. O. M. Poe, Corps of Engineers:

1. Preliminary examination of the lower part of the Licking River, Kentucky, for an ice harbor, including lock and dam, at a point about 3 miles from its mouth.—Major Lockwood submitted report of examination October 10, 1894. It is his opinion and that of the division engineer, concurred in by this office, that the Lower Licking River is not worthy of improvement by the General Government for the purposes of an ice harbor. The report was transmitted to Congress and printed in House Ex. Doc. No. 60, Fifty-third Congress, third session. (See also Appendix G G 15.)

2. Preliminary examination of Guyandotte River, West Virginia, with a view of improvement by locks and dams.—Major Lockwood submitted report of examination November 8, 1894. He states that since 1878 more or less work has been done on the Guyandotte in the way of improving navigation for push boats and running out logs, but that, in his opinion, the river is not worthy of improvement by the General Government in the manner indicated in the act. The division engineer also reports the Guyandotte River as not worthy of improvement by locks and dams, and his opinion is concurred in by this office. The report was transmitted to Congress and printed in House Ex. Doc. No. 39, Fifty-third Congress, third session. (See also Appendix G G 16.)

3. Preliminary examination of Little Kanawha River, West Virginia, with a view of improvement by locks and dams.—Major Lockwood submitted report of examination December 1, 1894. It is his opinion and that of the division engineer, concurred in by this office, that the river is not worthy of improvement by the General Government in the manner indicated in the act. The report was transmitted to Congress and printed in House Ex. Doc. No. 98, Fifty-third Congress, third session. (See also Appendix G G 17.)

LAKE RIVERS AND HARBORS.

IMPROVEMENT OF RIVERS AND HARBORS ON LAKE SUPERIOR.

This district was in the charge of Maj. Clinton B. Sears, Corps of Engineers, with Lieut. Charles H. McKinstry, Corps of Engineers, under his immediate orders since September 3, 1894; Division Engineer, Col. O. M. Poe, Corps of Engineers.

1. Harbor at Grand Marais, Minn.—This small natural basin was not originally of sufficient depth, nor was it adequately sheltered either for commercial purposes or for use as a harbor of refuge; the approved project of 1879, therefore, proposed two breakwater piers each 350 feet long, from the east and west points of the bay, or one pier 700 feet long from the east point, and the dredging to a depth of at least 16 feet of

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an anchorage area of about 26 acres, at a total estimated cost of $139,669.40. Up to the close of the fiscal year ending June 30, 1895, there has been expended on this work $126,319.35. With this sum 350 feet of the east pier has been completed and the 16-foot anchorage area increased to 23.5 acres. There remains to be dredged to complete the dredging project 2.5 acres. The act of August 17, 1894, appropriated $3,000 for continuing the improvement. This will be expended in dredging under a contract.

July 1, 1894, balance unexpended	$1,190.07
Amount appropriated by act of August 17, 1894	3,000.00
	4,190.07
June 30, 1895, amount expended during fiscal year	159.42
July 1, 1895, balance unexpended	4,030.65
July 1, 1895, amount covered by uncompleted contracts	3,000.00
July 1, 1895, balance available	1,030.65
Amount (estimated) required for completion of existing project	9,319.40
Amount that can be profitably expended in fiscal year ending June 30, 1897	3,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix H H 1.)

2. Harbor at Agate Bay, Minnesota.—This is a shipping port for iron ore, and when the breakwater piers are built will form a harbor of refuge. It is 27 miles east of Duluth.

The project for the improvement of this harbor was adopted in 1887, and contemplates the erection of two piers projecting from the headlands of the bay and inclosing about 109 acres of water area. The eastern pier is to be 1,000 feet long and the western one 900 feet. Work upon the east pier was commenced in 1887, and at the close of work in November, 1891, 750 feet of it had been built. In 1893, 200 feet of the west pier was built. The act of August 17, 1894, appropriated $30,000 for continuing the improvement. This will be expended in building a riprap foundation embankment to receive the cribs and superstructure for the prolongation of the west pier. This work is now in progress under a contract. One thousand one hundred and ninety-three cords of stone has been placed in position, equivalent to completing 92 linear feet of embankment. It is estimated that the funds in hand will complete 350 feet of embankment.

The amount expended to June 30, 1894, was $89,222.24; amount expended during fiscal year ending June 30, 1895, $4,618.93.

July 1, 1894, balance unexpended		$3,277.76
Amount appropriated by act of August 17, 1894		30,000.00
		33,277.76
June 30, 1895, amount expended during fiscal year		4,618.93
July 1, 1895, balance unexpended		28,658.83
July 1, 1895, outstanding liabilities	$2,114.92	
July 1, 1895, amount covered by uncompleted contracts	20,381.60	
		22,496.52
July 1, 1895, balance available		6,162.31
Amount (estimated) required for completion of existing project		121,708.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		30,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix H H 2.)

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3. Harbor at Duluth, Minn.—The original project for the improvement of the harbor, adopted in 1871, consisted of a breakwater in Lake Superior outside of Minnesota Point in continuation of one already commenced by the Northern Pacific Railroad Company. This breakwater was destroyed by a storm in 1872 and abandoned. In 1873 Congress provided for maintaining the canal through Minnesota Point, which had been constructed by the city of Duluth, and for dredging channels in Superior Bay to the Duluth docks.

Work under this project was continued until 1881, at which time the piers of the canal had been repaired and somewhat extended, a harbor basin dredged of moderate capacity, and a narrow channel dredged in Superior Bay from Duluth to deep water at Connor Point. The amount expended under this project was $270,651.81.

The present project was adopted in 1881 and modified in 1884 and 1888, the object being to preserve the piers bordering the canal, dredging an inner harbor to accommodate vessels drawing 16 feet of water, a channel parallel with the Park Point dock line 100 feet wide, a channel east of Rice Point 200 feet wide and 17 feet deep, and a channel along the north shore of St. Louis Bay 200 feet wide, 17 feet deep.

The river and harbor act of July 13, 1892, authorized the expenditure of $45,000 of the amount appropriated for this harbor in improving the channel of St. Louis River above Grassy Point. Of this only $22,500 was so expended, giving an available depth of 16 feet to Ironton, 4½ miles up the river. The act of August 17, 1894, appropriated $75,000 for continuing the improvement of Duluth Harbor, of which $25,000 was authorized to be expended above Grassy Point. Practically, the whole of this appropriation for Duluth Harbor will be expended for contingencies and in dredging under a contract now in execution, and has been allotted as follows: $50,000 for Duluth Harbor proper, and $25,000 for the St. Louis River above Grassy Point. The first-named sum will widen the present 16-foot channels on the north side of St. Louis Bay, and the second will extend the 16-foot navigation up to New Duluth, 10 miles above Grassy Point.

The balance left over at the end of the last fiscal year has been expended in thoroughly repairing the superstructure of the canal piers at the entrance and in office expenses.

A joint resolution of Congress of June 29, 1894, directed the appointment of a Commission of Engineers to prepare a 20-foot project for this harbor. The report of this Commission was published as House Ex. Doc. No. 59, Fifty-third Congress, third session; it is also submitted herewith in Appendix H H 3.

The total amount expended on the harbor to June 30, 1895, is $791,332.50, of which $270,651.81 was expended prior to the adoption of the present project; the amount expended under the present project to the same date is $520,680.69. The work has resulted in increasing the dredged area of the harbor basin to about 104 acres, exclusive of private dredging, removing shoals from area previously dredged, giving nearly the whole dredged basin a minimum depth of 16 feet, maintaining the canal piers, making 16-foot channels east and west of Rice Point and on north shore of St. Louis Bay, and carrying the 16-foot depth to the head of Spirit Lake, about 7¼ miles up the St. Louis River. A survey made on and through the ice last winter shows the channels to be in good condition and practically unimpaired.

The canal piers are in a poor condition and the entire work needs to be replaced with an improved and permanent structure. Over $7,000 has been expended during the year in their repair.

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It is extremely desirable that the existing basins and channels should be deepened to 20 feet, so as to make completely available the 20-foot channel between Buffalo and Lake Superior, now rapidly approaching completion. Fifty per cent of the commerce passing through the Sault Ste. Marie Canal comes to Duluth and Superior.

In compliance with the requirement of the last river and harbor act negotiations have been opened with the city of Duluth to deed to the United States the land covered by the canal and its piers not already owned by the United States. The matter is still pending.

July 1, 1894, balance unexpended		$9,317.67
Amount appropiated by act of August 17, 1894		75,000.00
		84,317.67
June 30, 1895, amount expended during fiscal year		23,350.97
July 1, 1895, balance unexpended		60,966.70
July 1, 1895, outstanding liabilities	$13,755.72	
July 1, 1895, amount covered by uncompleted contracts	35,103.85	
		48,859.57
July 1, 1895, balance available		12,107.13
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		75,000.00

(See Appendix H H 3.)

4. Harbor at Superior Bay and St. Louis Bay, Wisconsin.—Originally the natural entry to Superior Bay was obstructed with shifting bars having at most but 9 feet depth of water over them.

The United States began the improvement of the entrance in 1867 by building two parallel piers. The piers are 350 feet apart, and a good deal of dredging has been necessary to obtain the required depth between them and in the channels leading to Connors Point and the Quebec dock and the new connecting channel in St. Louis Bay. The original project of 1867 has therefore been modified from time to time to meet the needs of the rapidly increasing capacity of the vessels visiting this port, the last modification being made by act of Congress approved August 5, 1886, which added the improvement of the channel in St. Louis Bay.

In carrying out the original project with modifications there had been expended to June 30, 1894, the sum of $295,339.92.

This resulted in giving 16-foot navigation at the entrance, through the natural channel, through an artificial channel leading to the Quebec dock, and an artificial channel along the dock line in St. Louis Bay clear through to the natural channel at Grassy Point.

The river and harbor act of August 17, 1894, appropriated $50,000 for continuing the improvement of this harbor. This is being expended in dredging to widen the existing channels and to continue the channel along the Superior Bay dock line from the Quebec channel to "The Gate" at Connors Point, under contract.

Some $8,500 of the balance on hand at the beginning of the fiscal year was expended in thoroughly repairing the superstructures on the entrance piers.

The land on which stands the southerly entrance pier does not belong to the United States, and should be acquired by purchase or condemnation.

A joint resolution of Congress of June 29, 1894, directed the appointment of a Commission of Engineers to prepare a 20-foot project for this

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harbor. Its report was published as House Ex. Doc. No. 59, Fifty-third Congress, third session; it is also submitted herewith in Appendix H H 3. It is extremely desirable that the existing basins and channels should be deepened to 20 feet, so as to make completely available the 20-foot channel between Buffalo and Lake Superior now rapidly approaching completion. Fifty per cent of the commerce passing through the Sault Ste. Marie Canal comes to Duluth and Superior.

Allouez Bay, Wisconsin, is an important part of Superior Harbor. The report on the survey of this bay, made in accordance with the last river and harbor act, was published as House Ex. Doc. No. 172, Fifty-third Congress third session; it is also submitted herewith as Appendix H H 13.

July 1, 1894, balance unexpended		$15,030.62
Amount appropriated by act of August 17, 1894		50,000.00
		65,030.62
June 30, 1895, amount expended during fiscal year		27,401.10
July 1, 1895, balance unexpended		37,629.52
July 1, 1895, outstanding liabilities	$12,805.34	
July 1, 1895, amount covered by uncompleted contracts	18,679.64	
		31,484.98
July 1, 1895, balance available		6,144.54
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		50,000.00

(See Appendix H H 4.)

5. Harbor at Ashland, Wis.—Ashland Harbor is located at the head of Chequamegon Bay, and originally had no protection from the waves which rolled into the bay or from the waves generated within the bay itself by storms.

The approved project is for the construction of a pile, slab, and rock breakwater, 8,000 feet long, northeast of the town, and for dredging a channel in front of the wharves of the city to accommodate vessels drawing 16 feet of water. During the season of 1889 a portion of the breakwater, 4,650 feet in length, was completed, but a severe storm in November of the same year destroyed the outer 50 feet, and the slab filling settled in some places. In 1891 1,080 feet and in 1893 1,683 feet were added to the breakwater, making its present length 7,363 feet.

The method of construction adopted was very cheap, very weak as to strength and durability, and only justified by the necessity of obtaining quickly as great a protection as the funds would permit.

In the near future to give it reasonable permanence throughout its length will require the expenditure of nearly twice what it has already cost. The portions first built have within the last eighteen months shown such great weakness that the whole of the amount appropriated by the last river and harbor act, $25,000, is being expended in making repairs. The work is being done by days' labor, the stone and slabs being purchased under contract. Even after the repairs have been made to the extent of the funds available the work will be in anything but a satisfactory condition.

The breach in Chequamegon Point made by the storm of May 18, 1894, shows no noticeable deepening or widening.

No dredging has yet been done in Ashland Harbor.

The total amount expended under approved project and in repairs to June 30, 1895, is $201,822.82.

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The breakwater had a marked influence in improving the tranquillity of the harbor.

July 1, 1894, balance unexpended		$2,354.58
Amount appropriated by act of August 17, 1894		25,000.00
		27,354.58
June 30, 1895, amount expended during fiscal year		16,677.40
July 1, 1895, balance unexpended		10,677.18
July 1, 1895, outstanding liabilities	$3,075.07	
July 1, 1895, amount covered by uncompleted contracts	5,061.52	
		8,136.59
July 1, 1895, balance available		2,540.59
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		25,000.00

(See Appendix H H 5.)

6. Harbor at Ontonagon, Mich.—The entrance to Ontonagon River, which forms the harbor, had but 7 feet depth in 1867, at which time the project for securing 12 feet depth by building parallel piers on either side of the mouth, extending to the 18-foot curve of depth in Lake Superior, and dredging a channel between the piers was adopted.

The west pier was built to a length of 2,675 feet, and the east pier to a length of 2,315 feet. This brought the outer end of the west pier very nearly out to the 18-foot curve of depth, as proposed. But this curve has advanced since, owing to the very considerable volume of sand carried into the lake by the river, and as it appears probable that the advance of the bar will keep pace with the extension of the piers unless a very considerable extension is made at once, it does not appear that economic considerations would justify any further extension of the piers at present.

For a time it seems that better results will be secured after the piers are put in repair by dredging across the bar after each spring freshet. A dredged channel through the bar and the remaining 150 feet of superstructure on the west pier were completed in 1891.

At the close of work in 1891 the channel was left with 16 feet of water in it, but the river freshets have partially filled this up since, and in 1894 some $6,200 was expended in dredging between the piers and inside the harbor after the spring freshet. This made the channel available to vessels drawing 12 feet.

The last river and harbor act appropriated $7,000 for this harbor. This is being expended in repairs to the piers under contract.

The amount expended during the fiscal year just closed was $9,281.18.

The total cost of the improvement to June 30, 1895, was $326,720.90.

July 1, 1894, balance unexpended		$10,660.28
Amount appropriated by act of August 17, 1894		7,000.00
		17,660.28
June 30, 1895, amount expended during fiscal year		9,281.18
July 1, 1895, balance unexpended		8,379.10
July 1, 1895, outstanding liabilities		4,160.24
July 1, 1895, balance available		4,218.86
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		7,000.00

(See Appendix H H 6.)

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7. Eagle Harbor, Michigan.—Previous to the improvement of Eagle Harbor the entrance was obstructed by a rocky reef with 8½ feet of water over the shoalest part.

The project for the improvement of this harbor was adopted in 1866 and modified in 1868, 1874, and 1878. The plan as finally carried out consisted in blasting and dredging through the rocky ledge a channel 130 feet wide and 14 feet deep, marking it with two guiding cribs, one on each side of the channel, and the removal of a number of bowlders.

The amount expended to the close of the fiscal year ending June 30, 1894, was $95,238.08, and has resulted in carrying out the above project, the work having been completed in 1879, and meeting the present demands of commerce.

During the fiscal year, $658.17 was expended in refilling deficient pockets and in redecking the superstructures on the piers.

No appropriation is asked for this harbor, as the funds available will probably be sufficient to keep the work in good order for several years longer.

July 1, 1894, balance unexpended	$1,761.92
June 30, 1895, amount expended during fiscal year	658.17
July 1, 1895, balance unexpended	1,103.75

(See Appendix H H 7.)

8. Waterway from Keweenaw Bay to Lake Superior via Portage Lake and River, Michigan.—This work has heretofore been reported on as the Portage Lake and Lake Superior canals, across Keweenaw Point, Michigan.

In accordance with the provisions of the river and harbor act of September 19, 1890, the United States purchased and assumed the charge and care of these canals on August 3, 1891.

The improvements consist of entrance piers at the harbor entrances on Lake Superior and Keweenaw Bay, canals and canal revetments, dredged cuts and channel ways, lights, and buoys. There are no locks.

When the United States assumed charge the piers and revetments were in a dilapidated condition, bars had formed at the harbor entrances, and many places in the channel ways had shoaled by deposition of material.

As the waterway is intended for the use of all vessels that navigate Lake Superior, and is actually used by a large proportion of them, it is necessary that the depth and width of the channels shall at least be equal to that of the St. Marys Falls Canal, which now limits the maximum draft and dimensions of the largest vessels which run to Lake Superior.

The approved project is for a 16-foot channel 70 feet wide, a renewal of the canal revetments, a reconstruction of the piers at the upper and lower entrances and their extension to 30 and 20 feet of water, respectively.

The river and harbor act of 1892 appropriated $50,000 and the last act $130,000. These amounts have been and are being expended in deepening and widening the present channels by dredging, in repairing the superstructure of the piers at the upper entrance, and in rebuilding the revetments near said entrance and in Lily Pond and the superstructure of the pier at the lower entrance and the revetment adjoining it.

The condition of the waterway has been greatly bettered since the United States acquired ownership, and no complaints from vessel men have been received this year. A least depth of 14 feet exists throughout the waterway.

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Regulations for the use of the canal have been formulated, approved by the Secretary of War, and promulgated, which gives them the force of law, for the violation of which penalties attach. The result has been marked and highly beneficial.

During the past season of navigation, that of 1894, the commerce through this waterway has amounted to 754,973 tons of commodities, having an estimated value of $28,099,533.50, and 37,636 passengers, being an increase over the traffic of 1893 of 222,345 tons, $5,577,460.16, and 5,552 passengers, respectively.

July 1, 1894, balance unexpended		$1,611.96
Amount appropriated by act of August 17, 1894		130,000.00
		131,611.96
June 30, 1895, amount expended during fiscal year		35,024.22
July 1, 1895, balance unexpended		96,587.74
July 1, 1895, outstanding liabilities	$23,722.74	
July 1, 1895, amount covered by uncompleted contracts	53,259.77	
		76,982.51
July 1, 1895, balance available		19,605.23

Amount (estimated) required for completion of existing project	1,115,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	75,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix H H 8.)

9. Operating and care of waterway from Keweenaw Bay to Lake Superior via Portage Lake and River, Michigan.—The expenses of operating and care of this waterway for the fiscal year ending June 30, 1892, during which it was acquired by the United States, were paid by an appropriation of $10,000 made for the purpose by act of September 19, 1890.

During the fiscal year ending June 30, 1895, $8,000 from the permanent indefinite appropriation of July 5, 1884, was expended in maintaining, by dredging, a practicable 14-foot stage of water, in superintendence and general operation of the canals, in guarding against encroachments on the legally established harbor lines, and in buoying and lighting the channel until this latter duty was assumed by the Light-House Board, in November, 1894.

(See Appendix H H 8.)

10. Harbor at Marquette, Mich.—Originally this harbor afforded no protection to vessels from easterly or northeasterly storms, and in 1866 a project was approved for the construction of a breakwater composed of cribs filled with rock and projecting from the shore into the bay a distance of 2,000 feet. This pier was finished practically as projected in 1875, but since its commencement extensive repairs have been made to the superstructure.

As the timber composing the superstructure has been in place longer than its durability justifies, it is essential that it be replaced by more durable material. A project for a concrete superstructure was approved in February, 1890. Its estimated cost was $232,936.71.

In the river and harbor act of August 11, 1888, provision was made for the extension of the breakwater. There was finished 60 feet of crib work and 180 feet of riprap foundation. The contract of 1890 extended the breakwater 240 feet, that for 1893 added 600 feet, and that for 1894 completed it to the total length of 3,000 feet, called for by the project.

The last river and harbor act appropriated $30,000 for the further improvement of this harbor. This, with the unexpended balance at

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close of last fiscal year, is being expended in beginning the project for the concrete superstructure.

A warehouse for storage of cement and bins for sand and broken stone have been built, and the plant, molds, etc., have been prepared. It is expected to begin the concrete laying on July 1.

The work is being done by days' labor, the material being bought by contract after due advertisement.

The amount expended during the fiscal year ending June 30, 1895, was $15,176.86.

The total cost of the work to June 30, 1895, is $478,443.50.

July 1, 1894, balance unexpended		$10,963.36
Amount appropriated by act of August 17, 1894		30,000.00
		40,963.36
June 30, 1895, amount expended during fiscal year		15,176.86
July 1, 1895, balance unexpended		25,786.50
July 1, 1895, outstanding liabilities	$2,692.44	
July 1, 1895, amount covered by uncompleted contracts	18,896.96	
		21,589.40
July 1, 1895, balance available		4,197.10
Amount (estimated) required for completion of existing project		227,936.71
Amount that can be profitably expended in fiscal year ending June 30, 1897		30,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix H H 9.)

11. Harbor of refuge at Grand Marais, Mich.—Originally the entrance to this harbor was obstructed by a bar having but about 9 feet depth of water upon it. The project for its improvement, adopted in 1881, has for its object a deep and safe channel into the harbor, making it a harbor of refuge. This object is to be attained by building parallel piers projecting into the lake and dredging out a channel between them, connecting the deep water of the lake with that of the harbor.

The proposed length of each pier was 1,800 feet. The west pier has now reached a length of 1,406 feet and the east pier 1,153 feet.

A channel 150 feet wide and 17 feet deep was dredged out between the piers in 1889, but it shoaled, and in 1891 it was again dredged, this time to a width of 175 feet and a least depth of over 17 feet, the outer ends of canal piers repaired, new shore ends and spurs put in, and the old shore ends remodeled. A partial survey in June, 1893, showed a shoaling to 14 feet. An examination made in June, 1894, showed that there was a least depth of 15.5 feet along the channel between the piers, and there is about the same at present for a corresponding gauge reading.

A survey in the fall of 1894 showed that the harbor was slowly but surely filling up through the wide opening between the east pier and the eastern shore. This necessitated an amendment to the project, providing for building a close pile dike clear across this open interval of some 6,000 feet. This has been approved by the Chief of Engineers.

The last river and habor act appropriated $20,000 for continuing the improvement, and this, with the unexpended balance from last year, is being expended in building a close pile dike, well tied together with waling and braced on inside where the depth of water requires it.

The total amount expended under approved project to June 30, 1894, was $255,214.55.

The amount expended during the year ending June 30, 1895, was $2,499.26.

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July 1, 1894, balance unexpended		$6,035.45
Amount appropriated by act of August 17, 1894		20,000.00
		26,035.45
June 30, 1895, amount expended during fiscal year		2,499.26
July 1, 1895, balance unexpended		23,536.19
July 1, 1895, outstanding liabilities	$2,135.42	
July 1, 1895, amount covered by uncompleted contracts	18,884.58	
		21,020.00
July 1, 1895, balance available		2,516.19

Amount (estimated) required for completion of original project	*188,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	30,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix H H 10.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations and surveys of the following localities required by the act of August 17, 1894, were made by the local engineer, Maj. Clinton B. Sears, Corps of Engineers, and reports thereon submitted through the division engineer, Col. O. M. Poe, Corps of Engineers:

1. Preliminary examination of harbors of Superior, Wis., and Duluth, Minn., with a view of deepening said harbors and entrances thereto to 20 feet.—The report of the results of this examination was submitted by Major Sears March 27, 1895. It is his opinion, concurred in by Col. O. M. Poe, Division Engineer, and by this office, that these harbors and the entrances thereto are worthy of improvement by the General Government. (See Appendix H H 11.)

In this connection it is proper to remark that Congress, by joint resolution of June 29, 1894, provided for and directed the appointment of a commission of three engineers to examine the harbors of Superior and Duluth and the entrances thereto, with a view of ascertaining the cost of deepening these harbors to a uniform depth of 20 feet. The report of this commission was submitted to Congress at its last session and printed in House Ex. Doc. No. 59, Fifty-third Congress, third session. It is also transmitted herewith in Appendix H H 3. An estimate amounting to $3,130,553 is submitted by the commission as the cost of the work proposed.

2. Preliminary examinations of mouth of Iron River, Lake Superior, and of Flag Lake, and mouth of Flag River, Wisconsin.—Major Sears submitted report of examinations October 20, 1894. It is his opinion and that of the division engineer, concurred in by this office, that these localities are not at present worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 65, Fifty-third Congress, third session. (See also Appendix H H 12.)

3. Survey of Allouez Bay, Wisconsin.—Major Sears submitted report of survey December 29, 1894. He submits projects for channels of different depths, as follows:

1. For a channel giving a navigable depth of 16 feet	$118,430
2. For a channel giving a navigable depth of 20 feet	316,810

* This does not include work on the pile dike.

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He states, in addition, that as a part of both projects the easterly pier at the Superior entrance should be rearranged as shown by parallel curved lines on the map,* and he estimates the cost of this at $11,680. The report was transmitted to Congress and printed in House Ex. Doc. No. 172, Fifty-third Congress, third session. (See also Appendix H H 13.)

4. Survey for canal connecting Lake Superior and Mississippi River.—The river and harbor act of August 17, 1894, appropriated $10,000 for the examination and survey for the location of a canal connecting Lake Superior and the Mississippi River, and designated three routes to be examined.

The survey is not yet completed, and it is expected that it will be finished by fall, when a detailed report will be submitted in time for transmission to Congress in December.

A report by Major Sears of the progress of this survey is submitted herewith as Appendix H H 14.

IMPROVEMENT OF RIVERS AND HARBORS ON WESTERN SHORE OF LAKE MICHIGAN.

This district was in the charge of Maj. James F. Gregory, Corps of Engineers, to January 24, 1895, and of Capt. Carl F. Palfrey, Corps of Engineers, since that date, with Lieut. Charles H. McKinstry, Corps of Engineers, under the immediate orders of Major Gregory to September 2, 1894; Division Engineer, Col. O. M. Poe, Corps of Engineers.

1. Manistique Harbor, Michigan.—The natural channel of entrance to the mouth of the Manistique River was 7 feet deep. By private enterprise 3,000 feet of slab piers had been built at the mouth of the river and a channel dredged to 10 feet before any appropriation had been made by the Government.

The project for the improvement of the harbor was adopted in 1880, and consisted in dredging between the piers built by the Chicago Lumbering Company, increasing the depth of the channel to 12 feet for a width of 150 feet.

By the acts of 1880 and 1881 the sum of $6,000 was appropriated for this harbor in order to dredge a channel between the private piers of the above-mentioned dimensions. Dredging was done to the amount of 11,780 cubic yards, and work was then suspended in consequence of the refusal of the company controlling the harbor to rectify their pier lines when rebuilding the same.

Nothing has been done since work was suspended in 1881.

Soundings taken in May 1892, show a navigable channel between the piers with a depth of 13 feet, but with a governing depth over the bar of about 11 feet.

The amount expended to June 30, 1894, was $3,571.60.

July 1, 1894, balance unexpended	$2,428.40
June 30, 1895, amount expended during fiscal year	71.00
July 1, 1895, balance unexpended	2,357.40

(See Appendix I I 1.)

2. Cedar River Harbor, Michigan.—Previous to improvement the mouth of Cedar River was 175 feet wide and 8 to 10 feet deep, with a 3-foot bar in front.

Improvements had been made by private parties prior to the commencement of Government work.

*Omitted; printed in House Ex. Doc. No. 172, Fifty-third Congress, third session.

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The project of improvement was adopted in 1883, with a modification in the direction of the piers in 1884, the object being to afford an entrance channel of navigable width and 14 feet in depth.

Up to June 30, 1894, there had been expended $28,190.97, resulting in the construction of two pile piers 754 and 301 feet long, respectively, in continuation of the slab docks built by private enterprise, and a channel that in October, 1885, was 50 feet wide and 13 feet deep and 100 feet wide for a depth of 11 feet.

Soundings taken in April, 1894, showed a channel about 40 feet wide, and under favorable conditions vessels drawing 14 feet could enter the harbor.

Work was suspended in November, 1885, and has not been resumed by the United States since that date. It is reported that some dredging was done by private parties in 1891 and 1892.

July 1, 1894, balance unexpended	$1,809.03
June 30, 1895, amount expended during fiscal year	71.00
July 1, 1895, balance unexpended	1,738.03
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	108,000.00

(See Appendix I I 2.)

3. Menominee Harbor, Michigan and Wisconsin.—Previous to the improvement of this harbor the depth of water at the mouth of the Menominee River was 4 feet, and the river was navigable for boats of that draft for some 2 miles above its mouth.

The project for the improvement of the harbor was adopted in 1871 and modified in 1874, the object being to afford a channel of entrance of navigable width and not less than 14 feet depth.

The original and modified projects are completed, the object sought obtained, and the present demands of commerce fully met.

The amount expended up to June 30, 1894, was $211,929.68, resulting in the construction of two piers 400 feet apart, the north pier 1,854 feet long and the south pier 2,710 feet long, with a dredged channel 3,000 feet long, 200 feet wide, and 16 feet deep from the 16-foot contour in Green Bay to the lower end of the channel of the Menominee River, of the same depth and width.

During the fiscal year ending June 30, 1895, 1,309 linear feet of the south pier were thoroughly repaired by the removal of three courses of superstructure and a new line of piling on the channel face of 488 linear feet of the same, the amount expended being $9,066.05.

The estimate for the year ending June 30, 1897, is $7,150, for maintenance of channel and piers.

July 1, 1894, balance unexpended	$132.32
Amount appropriated by act of August 17, 1894	10,000.00
	10,132.32
June 30, 1895, amount expended during fiscal year	9,066.05
July 1, 1895, balance unexpended	1,066.27
Amount that can be profitably expended in fiscal year ending June 30, 1897, for maintenance. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	7,150.00

(See Appendix I 1 3.)

4. Menominee River, Michigan and Wisconsin.—The river and harbor act of September 19, 1890, appropriated $54,000 for "continuing the

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improvement up the river from termination of old work," and the original approved project was for dredging a channel 200 feet wide and 16 feet deep from Green Bay up the Menominee River as far as the funds available would allow, the object being to create a navigable channel 16 feet deep from Green Bay to N. Ludington Company's mill, a distance of about 2 miles. The project has been modified by reducing the upper 2,600 linear feet to a width of 100 feet.

The original navigable depth was about 4 feet.

When work was begun on the improvement in question the United States had increased the depth at the mouth of the river to 14 feet, and by private enterprise a tortuous channel had been dredged, with a governing width of 50 feet and depth of 13 feet, extending up the river for a distance of 2 miles.

A large portion of the improvement made by private parties, however, was situated entirely outside of the limits of the present channel.

The amount expended to June 30, 1894, was $74,305.76.

The lower section, some 9,000 feet long, had then a width of 200 feet, except for a limited portion of its length, and a general depth of 16 feet. The upper section, about 2,500 feet long, was practically completed for about 2,200 linear feet; the governing depth in the remainder was about 8 feet.

During the fiscal year ending June 30, 1895, $3,877.31 was expended in dredging.

The lower section, about 9,000 feet long, has now a channel 200 feet wide for practically its entire length, and a general depth of 16 feet. The upper section, about 2,500 feet long, is completed.

July 1, 1894, balance unexpended	$274.27
Amount appropriated by act of August 17, 1894	6,000.00
	6,274.27
June 30, 1895, amount expended during fiscal year	3,877.31
July 1, 1895, balance unexpended	2,396.96
Amount (estimated) required for completion of existing project	4,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897, for maintenance	6,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix I I 4.)

5. *Oconto Harbor, Wisconsin.*—In its natural condition the channel at the entrance to the Oconto River was obstructed by a bar with less than 2 feet of water over it. Previous to 1881, when the first appropriation was made for its improvement, the citizens, by the construction of a small amount of slab pier and by dredging, had increased the depth to 3½ feet.

The project of improvement adopted in 1882 proposes to secure an 8-foot channel from Green Bay to the city of Oconto, a distance of 2 miles, by dredging and constructing piers, at an estimated cost of $150,000.

The total amount expended up to June 30, 1894, was $69,445.52, resulting in the building of two piers, the north pier 1,603 feet and the south pier 2,151 feet in length, the latter being the full length contemplated by the approved project, in the removal of 405,356 cubic yards of material, and minor repairs. Owing to the narrowness of the dredged channel and the soft character of the material the spring freshets have a tendency to obliterate in places the dredging of previous years.

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In September, 1894, the governing depth of water from the harbor entrance to the shore line was 10 feet, and there was about 7 feet in the river as far up as Spies's Mill, a distance of 6,500 feet.

Under provisions of the river and harbor act of August 17, 1894, a preliminary examination was made and report submitted for a channel 16 feet deep and 150 feet wide. This report is printed in House Ex. Doc. No. 54, Fifty-third Congress, third session. It is also submitted herewith as Appendix I I 25.

During the fiscal year ending June 30, 1895, $452.96 was expended.

July 1, 1894, balance unexpended	$1,554.48
Amount appropriated by act of August 17, 1894	3,000.00
	4,554.48
June 30, 1895, amount expended during fiscal year	452.96
July 1, 1895, balance unexpended	4,102.52
Amount (estimated) required for completion of existing project	79,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	3,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix I I 5.)

6. Pensaukee Harbor, Wisconsin.—The original depth of water at the mouth of Pensaukee River was 2 feet, increased by private enterprise to from 7 to 9 feet for a width of 30 feet.

The project for the improvement of this harbor was adopted in 1883, and consisted of the construction of a single slab pier 2,500 feet long, in continuation of the pier built by private enterprise, and dredging a channel 10 feet deep and 100 feet wide on the south side of the pier.

The total amount expended up to June 30, 1894, was $14,006.64, resulting in the construction of 1,300 feet of the proposed extension of the pier and the dredging of 5,698 cubic yards of material, making a channel 25 feet wide and 10 feet deep.

About 600 linear feet of the west end of the pier, damaged by fire in September, 1891, was repaired in October and November, 1891.

The last survey, made in May, 1890, showed the governing depth to be 2.8 feet.

There were no operations during the fiscal year ending June 30, 1895.

July 1, 1894, balance unexpended	$993.36
July 1, 1895, balance unexpended	993.36
Amount (estimated) required for completion of existing project	35,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

(See Appendix I I 6.)

7. Green Bay Harbor, Wisconsin.—Before the improvement of this harbor was begun the channel between the mouth of the Fox River and the deep water in Green Bay was circuitous and narrow, with but 6 feet of water at its shoalest point.

The project of improvement was adopted in 1866, and subsequently modified so as to provide increased depth in 1872 and 1874, the object being to provide a dredged channel 200 feet wide, 14 feet deep, and 2 miles long in place of the natural channel, with a revetted cut across Grassy Island.

The project was further modified in 1892 to increase the depth of the present channel to 16 feet and extend it in a direct line through the bar off Sable Point, making its total length 16,500 feet.

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The act of Congress of July 13, 1892, appropriating $25,000 for improving harbor at Green Bay, Wis., provided "that $5,000 of said sum may, in the discretion of the Secretary of War, be expended on the Fox River, below De Pere, Wis."

There was expended up to the close of the fiscal year ending June 30, 1894, $321,519.04, resulting in a dredged channel 10,600 feet long, 200 feet wide, and 14 feet deep, and in the construction of 1,325 linear feet of revetment of the sides of a cut through Grassy Island. Work on the 16-foot channel was in progress and about 10,200 linear feet completed for a width of 100 feet.

From the channel of the Fox River, between De Pere and Green Bay, 41,705 cubic yards of material was removed, resulting in a channel way 12 feet deep and 150 feet wide.

During the fiscal year ending June 30, 1895, $5,687.46 was expended, resulting in the removal of 48,879.4 cubic yards of material from the 16-foot channel. It is expected to complete the 16-foot channel for a width of 100 feet to its entire length during the present working season.

Harbor lines extending from Grignon Point to the mouth of Fox River were approved by the Secretary of War November 10, 1894.

July 1, 1894, balance unexpended	$1,083.46
Amount appropriated by act of August 17, 1894	25,000.00
	26,083.46
June 30, 1895, amount expended during fiscal year	5,687.46
July 1, 1895, balance unexpended	20,396.00
July 1, 1895, amount covered by uncompleted contracts	17,875.79
July 1, 1895, balance available	2,520.21
Amount (estimated) required for completion of existing project	46,915.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix I I 7.)

8. *Sturgeon Bay and Lake Michigan Ship Canal, Wisconsin.*—The Sturgeon Bay and Lake Michigan Ship Canal is a waterway cut through the neck of land separating Green Bay from Lake Michigan, and connects Lake Michigan with Sturgeon Bay, an arm of Green Bay, about 8 miles long, extending eastward into the peninsula and narrowing it at that point.

The canal was constructed by the Sturgeon Bay and Lake Michigan Ship Canal and Harbor Company, from 1872 to 1881, from the proceeds of sale of 200,000 acres of public lands granted to the State of Wisconsin for the purpose by acts of Congress of April 10, 1866, and March 1, 1872. A full history and description of the work is given in the Annual Report, Chief of Engineers, 1887, pages 2017 to 2037, and in House Ex. Doc. No. 106, Forty-ninth Congress, second session.

The canal affords a considerable shortening of distance for many vessels over the natural outlet of Green Bay into Lake Michigan, about 50 miles to the north, admits the avoidance of the dangers of the natural route, and makes Sturgeon Bay available and accessible as a harbor of refuge for vessels on Lake Michigan.

The river and harbor act approved July 13, 1892, appropriated $81,833 for making the canal free to commerce. The conditions of the act being fulfilled, the property was purchased from the company and the money appropriated therefor paid in April, 1893, and the United States assumed possession of the canal on April 25, 1893.

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The canal is an open cut, without locks or gates, 7,200 feet long; it is 100 feet wide at the water surface, about 65 feet wide at bottom, and 13 feet deep. Harbor works at the Lake Michigan entrance have been constructed by the United States. Dredging has been done in continuation of the channel 6,100 feet into Sturgeon Bay. The banks are only partly revetted; 8,437 feet of the existing revetments require extensive repairs, and 6,000 feet remain to be constructed.

The foregoing is a description of the work and its condition at the close of the fiscal year ending June 30, 1894, and the amount expended by the United States was $81,833.

During the fiscal year ending June 30, 1895, $5,699.74 was expended in the purchase of materials and in making preliminary arrangements for the construction of 1,200 linear feet in extension of north revetment and 1,000 linear feet of fender piling.

The existing project submitted in 1893 provides for extending the revetments to the 14-foot contour in Sturgeon Bay and widening this portion of the canal to 160 feet, at an estimated cost of $98,450. An appropriation of $20,000 was made for this work by the river and harbor act of August 17, 1894.

Amount appropriated by act of August 17, 1894	$20,000.00
June 30, 1895, amount expended during fiscal year	5,699.74
July 1, 1895, balance unexpended	14,300.26
July 1, 1895, outstanding liabilities	10.87
July 1, 1895, balance available	14,289.39
Amount (estimated) required for completion of existing project	78,450.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix I I 8.)

9. Operating and care of Sturgeon Bay and Lake Michigan Ship Canal, Wisconsin.—Under the continuous appropriation for operating and care of canals and other works of navigation, 48,945 cubic yards of material was removed for maintenance of the canal, and necessary repairs made to the revetments, etc., pertaining to the canal, during year ending June 30, 1895.

The amount expended under the indefinite appropriation provided by section 4 of the river and harbor act of July 5, 1884, during the fiscal year, was $11,567.25. The detailed statement appended to the report of the local engineer officer shows the items of expenditure.

For the year ending June 30, 1896, it is proposed to maintain existing works by such dredging and repairs as may be necessary.

(See Appendix I I 9.)

10. Harbor of refuge at entrance of Sturgeon Bay and Lake Michigan Ship Canal, Wisconsin.—Before the construction of this harbor was undertaken the Lake Michigan entrance to the Sturgeon Bay and Lake Michigan Ship Canal was entirely unprotected from storms ranging from northeast and southwest.

The project of constructing a harbor of refuge at this point was adopted in 1873 and modified in 1879 and 1880. The modified project, as carried out, consists of two piers, each 1,344 feet long, 850 feet apart at the shore line, protecting the lake entrance of the canal, and converging so as to make the harbor entrance 335 feet wide, inclosing an area of about 10 acres, with a depth of at least 16 feet.

The total expenditure at this harbor up to June 30, 1894, was $171,421.60, resulting in the completion of the piers as projected and

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in a dredged channel 16 feet deep and 120 feet wide from the 16-foot contour in Lake Michigan to the canal entrance.

During the fiscal year ending June 30, 1895, $1,374.66 was expended, resulting in the removal of 9,025 cubic yards of material and the restoration of the channel to the required depth for a part of its width; also minor repairs to south pier.

July 1, 1894, balance unexpended	$1,760.90
Amount appropriated by act of August 17, 1894	5,000.00
	6,760.90
June 30, 1895, amount expended during fiscal year	1,374.66
July 1, 1895, balance unexpended	5,386.24

Amount that can be profitably expended in fiscal year ending June 30, 1897, for maintenance	2,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix I I 10.)

11. Ahnapee Harbor, Wisconsin.—Previous to the improvement of this harbor the depth of water at the mouth of the Ahnapee River was only 2 feet.

The project of improvement, adopted in 1875 and modified in 1884, provided for the formation of a small artificial harbor, connected with the lake by a channel 100 feet wide and 12 feet deep, formed by the construction of two piers extending to the 18-foot contour, with a 200-foot entrance channel between the pierheads.

The total amount expended up to June 30, 1894, was $170,985.83, resulting in the construction of two piers, the north one 1,102 feet long and the south one 1,125 feet, and 225.6 linear feet of guide piling; in the removal of 30,528 cubic yards of rock and 137,893 cubic yards of sand and gravel, and in placing a double row of sheet piling along 352 feet of the north pier and 620 feet of the south pier. The rock was used for refilling and riprapping the piers.

The depth of water at the entrance was about 16 feet and 10½ feet at the shore ends of the piers.

Of the area from which rock had been excavated, one-third had the required depth of 12 feet, the remaining two-thirds an average depth of about 9 feet.

During the fiscal year ending June 30, 1895, $2,857.63 was expended. Three hundred and sixty-two linear feet of south pier superstructure was rebuilt and minor repairs made.

Soundings taken in April, 1895, showed a depth of water at the entrance of 15½ feet and at the shore ends of the harbor piers about 10 feet.

July 1, 1894, balance unexpended	$2,234.17
Amount appropriated by act of August 17, 1894	5,000.00
	7,234.17
June 30, 1895, amount expended during fiscal year	2,857.63
July 1, 1895, balance unexpended	4,376.54

Amount (estimated) required for completion of existing project	15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix I I 11.)

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12. Kewaunee Harbor, Wisconsin.—The natural channel to this harbor was through the Kewaunee River. The river mouth was not more than 20 feet wide, with a depth of about 2 feet at its shoalest point, and was obstructed by submerged bowlders.

The project of improvement was adopted in 1881. Its design was to cut a channel 14 feet deep through a neck of land between the river and the lake at a point about 2,000 feet south of the river mouth and to continue this channel to deep water in the lake by the construction of two parallel piers, 200 feet apart, extending from each side of the cut lakeward to the 18-foot contour.

The total amount expended on this harbor up to the close of the fiscal year ending June 30, 1894, was $104,439, in addition to which the local harbor commissioners had expended $8,042.72. At that time 1,500 feet of the north pier and 1,425 feet of the south pier had been constructed, and there was a governing depth in the entrance channel of about 13.6 feet.

During the fiscal year ending June 30, 1895, $1,531.59 was expended.

Work was begun for the extension of each pier 200 feet, and is in progress at close of fiscal year.

Soundings taken in April, 1895, showed a channel about 80 feet wide, with a depth of 13 feet.

July 1, 1894, balance unexpended	$575.00
Amount appropriated by act of August 17, 1894	20,000.00
	20,575.00
June 30, 1895, amount expended during fiscal year	1,531.59
July 1, 1895, balance unexpended	19,043.41
July 1, 1895, amount covered by uncompleted contracts	15,000.00
July 1, 1895, balance available	4,043.41
Amount (estimated) required for completion of existing project	66,943.28
Amount that can be profitably expended in fiscal year ending June 30, 1897	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix I I 12.)

13. Two Rivers Harbor, Wisconsin.—Previous to the improvement of this harbor the natural channel was obstructed by a bar covered by but 2 or 3 feet of water.

The project of improvement adopted in 1870 provided for the formation of a channel of navigable width and not less than 12 feet deep, to be accomplished by the construction of two piers, extending from the mouth of Two Rivers lakeward to the 18-foot contour in Lake Michigan, and dredging a channel between them.

The amount expended up to the close of the fiscal year ending June 30, 1894, was $205,949.07, which was expended in the construction of two parallel piers, the north and south pier being 1,810 and 1,710 feet long, respectively, in dredging, and in repairs to piers. Dredging to restore the channel 120 feet wide and 12 feet deep was completed.

During the fiscal year ending June 30, 1895, $3,008.39 was expended.

Shoaling having occurred dredging was resumed in September, 1894, resulting in a restoration of the channel to a depth of 12 feet and least width of 90 feet.

Minor repairs were made to the north pier.

Soundings taken in April, 1895, indicated considerable shoaling in the channel, the available depth being about 11½ feet.

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July 1, 1894, balance unexpended	$550.93
Amount appropriated by act of August 17, 1894	3,000.00
	3,550.93
June 30, 1895, amount expended during fiscal year	3,008.39
July 1, 1895, balance unexpended	542.54
Amount (estimated) required for completion of existing project	56,088.80
Amount that can be profitably expended in fiscal year ending June 30, 1897	3,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix I I 13.)

14. Manitowoc Harbor, Wisconsin.—Previous to the improvement of this harbor but 3 feet of water existed at the shoalest point over the bar at the mouth of the Manitowoc River.

The original project, adopted in 1852, provided for the construction of two parallel piers 220 feet apart, extending from the mouth of the river to the 12-foot contour in Lake Michigan. In 1881 this was modified so as to secure a deeper channel by extending the piers to a depth of 18½ feet and dredging to not less than 14 feet.

A supplementary project for the construction of an exterior breakwater 400 feet long to cost $40,000, and afford protection from northeast storms, was submitted in 1890.

The total amount expended up to June 30, 1894, was $313,176.67, resulting in the construction of two piers, the north one 1,970 feet and the south one 1,900 feet long, 228 feet apart at the shore line and 250 feet at the outer ends; renewal of superstructure of piers, and in the removal of 201,064 cubic yards of material by dredging.

The channel had a navigable depth of 14 feet.

During the fiscal year ending June 30, 1895, $6,953.55 was expended in dredging, resulting in the formation of a channel 150 feet wide and 16 feet deep, and in repairs to dredging plant. At the close of the fiscal year work is in progress on the exterior breakwater, one crib having been sunk June 25, 1895.

Estimate for year ending June 30, 1897, for maintenance of channel and repairs of piers, is $8,000.

July 1, 1894, balance unexpended		$22,863.83
Amount appropriated by act of August 17, 1894		20,000.00
		42,863.83
June 30, 1895, amount expended during fiscal year		6,953.55
July 1, 1895, balance unexpended		35,910.28
July 1, 1895, outstanding liabilities	$6.24	
July 1, 1895, amount covered by uncompleted contracts	30,000.00	
		30,006.24
July 1, 1895, balance available		5,904.04
Amount (estimated) required for completion of existing project		5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897, for maintenance		8,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix I I 14.)

15. Sheboygan Harbor, Wisconsin.—Previous to the improvement of this harbor the natural channel had a depth not exceeding 4 feet on the bar at the entrance of the river.

The original project for the improvement of this harbor was adopted in 1852, and had for its object the formation of a 12-foot channel entrance

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to the mouth of the Sheboygan River. This was modified in 1873 so as to secure a deeper channel by further pier extension and dredging. Both projects were completed within their estimated cost, and a channel was formed 100 feet wide, with a depth of 15 to 16 feet between the piers. This was further modified in 1881, the present project having for its object to deepen the channel still further by extending the piers to the 20-foot contour in the lake and dredging to a depth of 18 feet between their outer ends, the depth decreasing to 14 feet at the shore line.

The total expenditure up to June 30, 1894, amounted to $340,938.51, resulting in the construction of a north and a south pier 2,370 and 2,487 feet long, respectively, and the removal by dredging of 289,038 cubic yards of material. The channel had a depth of 15.6 feet.

During the fiscal year ending June 30, 1895, $7,599.89 was expended in dredging, resulting in the formation of a channel 17 feet deep and 90 feet wide; also in repairs to dredging plant.

At close of fiscal year work is in progress for the construction of 900 linear feet of pile pier, in renewal of inshore portion of south pier on rectified line.

July 1, 1894, balance unexpended	$2,510.40
Amount appropriated by act of August 17, 1894	25,000.00
	27,510.40
June 30, 1895, amount expended during fiscal year	7,599.89
July 1, 1895, balance unexpended	19,910.51
July 1, 1895, amount covered by uncompleted contracts	14,000.00
July 1, 1895, balance available	5,910.51
Amount (estimated) required for completion of existing project	81,900.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix I I 15.)

16. Port Washington Harbor, Wisconsin.—The natural channel at the mouth of the Sauk River was narrow, and at the shoalest point had a depth of but 1 foot.

The original project for the improvement of this harbor was adopted in 1869, and provided for two parallel piers, extending to 10 feet of water in Lake Michigan, and the excavation of an interior basin. This plan was modified in 1870 and again in 1876, and now provides for the excavation of two interior basins, with a combined area of 5¾ acres with a depth of 12 feet, and a channel of the same depth connecting the basins with the lake.

The total expenditure up to June 30, 1894, was $183,814.05, and resulted in the construction of a north and a south pier 920 and 1,226 feet long, respectively, with 400 feet of revetment along the north bank of the river, extending to the inner end of the south pier, and in the formation of two interior dredged basins of 2¾ and 3 acres, respectively. The north basin had a depth of 11½ feet over nearly its entire area; the west basin had a depth of 11 feet over its north half and 4 feet over its south half.

There was expended during the fiscal year ending June 30, 1895, $1,034.34 for dredging. This work is in progress at close of fiscal year.

Soundings taken in April, 1895, indicated a ruling depth of water in the entrance channel of 9½ feet; since then the depth has been restored to 12 feet for a width of 90 feet.

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July 1, 1894, balance unexpended	$222.45
Amount appropriated by act of August 17, 1894	5,000.00
	5,222.45
June 30, 1895, amount expended during fiscal year	1,034.34
July 1, 1895, balance unexpended	4,188.11
Amount that can be profitably expended in fiscal year ending June 30, 1897, for maintenance Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	2,500.00

(See Appendix I I 16.)

17. Harbor of refuge at Milwaukee Bay, Wisconsin.—The project for the work was approved in 1881, and contemplated the formation of an artificial harbor, by inclosing a portion of Lake Michigan forming Milwaukee Bay, within a breakwater of crib work upon a stone foundation. This harbor will furnish 417 acres of safe mooring ground beyond the 18-foot contour and about twice this area beyond the 12-foot contour.

The actual length of the breakwater when completed will be 7,250 feet.

Work began in 1881, and up to June 30, 1894, there had been expended $562,343.96, resulting in the completion of 4,250 running feet of substructure and 4,150 feet of superstructure, and extensive repairs.

During the fiscal year ending June 30, 1895, work was begun (June 1) for an extension of 400 feet, and is now in progress; the stone foundation is partially completed, but no cribs are yet sunk in place.

The amount expended, including maintenance of light-ship at south end of breakwater, during the fiscal year was $3,662.81.

On the completion of work under present contract there will remain 2,600 feet of substructure and 3,100 feet of superstructure to be constructed to complete the work.

The harbor is now used to a considerable extent as a shelter from easterly and northeasterly storms, and its value will rapidly increase as the breakwater is extended.

July 1, 1894, balance unexpended		$3,918.13
Amount appropriated by act of August 17, 1894		45,000.00
		48,918.13
June 30, 1895, amount expended during fiscal year		3,662.81
July 1, 1895, balance unexpended		45,255.32
July 1, 1895, outstanding liabilities	$3,529.35	
July 1, 1895, amount covered by uncompleted contracts	36,470.65	
		40,000.00
July 1, 1895, balance available		5,255.32
Amount (estimated) required for completion of existing project		188,737.91
Amount that can be profitably expended in fiscal year ending June 30, 1897		45,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix I I 17.)

18. Milwaukee Harbor, Wisconsin.—The original depth of water at the mouth of the Milwaukee River was not more than 3½ feet.

The original project was adopted in 1852, and was directed in securing 12 feet of water in an artificial channel 3,000 feet above the natural mouth of the river and to protecting the channel by parallel piers. In 1868 this was modified so as to secure a channel 18 feet deep by extending the piers 600 feet and dredging. This project has been completed, and consequently the only expenditures now demanded are for the maintenance of the piers by timely repairs and the depth of the channel by dredging.

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Up to the close of the fiscal year ending June 30, 1894, there had been expended on this harbor $338,766.64, in addition to $321,355.66 expended by the city of Milwaukee, resulting in the completion of the modified project of 1868.

During the fiscal year ending June 30, 1895, $7,083.40 has been expended in dredging, resulting in the formation of a channel 140 feet wide and 19 feet deep, and in minor repairs to piers.

Survey of harbor at South Milwaukee, Wis.—Under the provisions of act of August 17, 1894, a survey of the harbor at South Milwaukee was made, and map and report of same are submitted herewith in Appendix I I 18.

July 1, 1894, balance unexpended	$658.72
Amount appropriated by act of August 17, 1894	7,000.00
	7,658.72
June 30, 1895, amount expended during fiscal year	7,083.40
July 1, 1895, balance unexpended	575.32
Amount that can be profitably expended in fiscal year ending June 30, 1897, for maintenance	7,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix I I 18.)

19. Racine Harbor, Wisconsin.—The entrance to this harbor originally varied in depth from absolute closure after storms to about 6 feet.

The original project was adopted in 1842 or 1843, and contemplated a channel 12 feet deep. In 1866 the project was modified to provide a channel 15 feet deep.

The project was further modified in 1889, providing for 300 feet extension to the north pier, 500 feet to the south pier, and an increase of channel depth of water to 16 feet.

There had been expended up to June 30, 1894, $289,720.55 in the construction of a north and a south pier 1,610 and 1,370 feet long, respectively, and in dredging the channel to 16 feet depth of water.

During the fiscal year ending June 30, 1895, there was expended $7,654.71. The north pier has been extended 150 feet to the full length contemplated, and an extension of 100 feet to the south pier will be completed at an early day. It is proposed to dredge at once about 21,000 cubic yards of material for the restoration of the channel.

The constant shoaling of the entrance to this harbor shows that until the south pier is extended to an equal length with north pier, and until the inshore portions of the piers are made impervious to the passage of sand, it will be impossible to secure a permanent channel of the projected depth. About 1,100 feet of the superstructure of the piers should be rebuilt.

July 1, 1894, balance unexpended	$64.45
Amount appropriated by act of August 17, 1894	20,000.00
	20,064.45
June 30, 1895, amount expended during fiscal year	7,654.71
July 1, 1895, balance unexpended	12,409.74
July 1, 1895, amount covered by uncompleted contracts	8,211.01
July 1, 1895, balance available	4,198.73
Amount (estimated) required for completion of existing project	19,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix I I 19.)

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20. Kenosha Harbor, Wisconsin.—The original depth of water at the mouth of Pike Creek varied from nothing to 3 feet.

The original plan of improvement was adopted in 1852, and was directed to securing a channel 12 feet deep by constructing parallel piers and dredging between them. This plan was modified in 1866 so as to secure 15 feet of water by extending the piers and dredging deeper.

A further modification of the project was made in 1889, providing for the extension of the north pier 300 and the south pier 600 feet.

The amount expended upon this harbor up to June 30, 1894, was $259,273.41, resulting in the construction of two piers north and south, 1,700 and 1,351 feet in length, respectively, 150 feet apart, with a channel of varying depth. In 1875 and 1876 the channel was dredged to 15 feet, but subsequent appropriations sufficed only to maintain a channel of about 12 feet. An area of about 3 acres was also dredged in the inner harbor to a depth of 14 feet.

The amount expended during the fiscal year ending June 30, 1895, was $1,653.02. Extensions to the north pier of 50 feet and to the south pier of 150 feet have been commenced, no part of which is as yet completed.

To complete the pier extension contemplated by the modified project of 1889 there remain to be constructed after completion of present contract 150 linear feet of north pier and 250 linear feet of south pier. The present channel between the piers and through the bar between the pierheads carries only 13 feet, and until the piers are extended as contemplated in the project it will be impossible to maintain a channel of the projected depth (15 feet). It is proposed to dredge at once about 10,000 cubic yards of material to secure a channel 90 feet wide and 14½ feet deep.

July 1, 1894, balance unexpended	$1,034.00
Amount appropriated by act of August 17, 1894	15,000.00
	16,034.00
June 30, 1895, amount expended during fiscal year	1,653.02
July 1, 1895, balance unexpended	14,380.98
July 1, 1895, amount covered by uncompleted contracts	11,000.00
July 1, 1895, balance available	3,380.98
Amount (estimated) required for completion of existing project	34,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	15,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix I I 20.)

21. Waukegan Harbor, Illinois.—Previous to the improvement there was no navigable channel or natural harbor at this place, the adopted project contemplating the construction of an artificial harbor.

A project was adopted in 1852 which provided for the construction of a breakwater parallel to the shore in 20 feet of water. One crib was placed in position, but was carried away by a storm.

The present project was adopted in 1880, and provides for the construction of an exterior basin of sufficient capacity for local trade by inclosing a portion of Lake Michigan with pile piers, the entrance channel between the piers and the inclosed area to be dredged to 12 feet.

There has been expended on this harbor up to the close of the fiscal year ending June 30, 1894, $171,116.77, resulting in the construction of 3,255 feet of pile pier and the removal of 140,880.6 cubic yards of material from the entrance channel and basin.

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The amount expended during the fiscal year ending June 30, 1895, was $778.09. A contract has been entered into for the construction of 240 linear feet of pile pier in extension of the south pier, and material for same has been delivered. It is expected that work will be commenced early in July.

The north pier is completed and the present contract will complete the south pier. Soundings taken in April, 1895, show the depth in the basin and channel to be 10 feet.

July 1, 1894, balance unexpended	$3,883.23
Amount appropriated by act of August 17, 1894	20,000.00
	23,883.23
June 30, 1895, amount expended during fiscal year	778.09
July 1, 1895, balance unexpended	23,105.14
July 1, 1895, amount covered by uncompleted contracts	12,000.00
July 1, 1895, balance available	11,105.14

Amount (estimated) required for completion of existing project	$41,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	20,000.00

(See Appendix I I 21.)

22. Fox River, Wisconsin.—The works for the improvement of the Fox River were purchased by the United States from the Green Bay and Mississippi Canal Company in 1872. With the exception of one stone lock they were all temporary structures, and were in bad condition. There was no low-water navigation on the Upper Fox, and on the Lower Fox navigation was uncertain.

The adopted project for the improvement of the Fox River contemplated the replacing of the temporary structures with permanent works, the construction of five additional locks on the upper river, and widening and deepening the channels throughout the river and canals to 6 feet depth and 100 feet width. The estimate for both rivers made in 1874 and 1876 was $3,745,663.

The work is now carried on under the project of a Board of Engineers submitted September 17, 1884, published in the Annual Report of the Chief of Engineers for 1885, approved by the Secretary of War December 10, 1885, as further modified by authority of the Chief of Engineers May 14, 1886.

The project provides for the renovation of 11 old locks, the deepening and widening of the channel of the Fox River from Montello to Green Bay to 6 feet depth and 100 feet width, and that from Portage to Montello 4 feet of water at low water be maintained. The estimate for this was $602,000.

The amount expended on the Fox and Wisconsin rivers from 1867 up to the close of the fiscal year ending June 30, 1894, including $145,000 paid to the Green Bay and Mississippi Canal Company for works of improvement under act of June 10, 1872, was $2,665,000, and under modified project for the Fox River $315,747.53, making a total of $2,980,747.53.

The result of the expenditure upon the Fox River was: The construction of 14 new locks of stone; 16 dams, 3 of which are temporary; 12 cut-offs; a head wall and feeder at the old first lock at Appleton; a wing dam of brush and stone for shore protection to the Portage Levee; a masonry wasteweir and culvert at head of combined lock; guard gates at head of Kaukauna Canal; rebuilding canal banks at Kau-

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kauna; wing walls at Kaukauna fourth lock, and 587 linear feet of cement-laid rubble core wall in canal banks of fourth and fifth levels; a channel 75 feet wide and 450 feet long by blasting and dredging the rock bar below De Pere lock to from 4 to 12 inches below the top of the lower miter sill; channel below De Pere excavated to 12½ feet depth for a width of from 50 to 60 feet; deepened channels at mouth of Fond du Lac River; Neenah Channel; Fox River at head of Lake Butte des Morts; Grignon Rapids; below Little Chute and Rapide Croche locks, and in the canals and Upper Fox River.

Section 4 of the act approved August 17, 1894, gives to the Secretary of War full authority to control this waterway. Under this authority, a rule approved February 15, 1895, prohibits draft of water "from any portion of the Fox River canals, or of the Fox River including its lakes, improved channels and unimproved channels, to such extent as to lower the water surface, at the dam next below the place where such draft of water is effected, below the crest of that dam."

Navigation closed, for the season, on November 13, 1894, and was formally reopened on May 11, 1895, the stage of water in this exceptional season being then too low for much actual navigation.

During the fiscal year ending June 30, 1895, $30,573.74 was expended, and the following work done: Crib dam at Berlin lock completed; fourth lock at Appleton rebuilt; a system of masonry wasteweirs for control of water stage in second, third, and fourth levels of the Kaukauna system completed; survey for location of new dam at White River lock made, materials for dam and land for straight cut purchased, and construction begun; survey for dredging 7-foot channel at mouth of Fond du Lac River made; repairs of works, buildings, and plant.

July 1, 1894, balance unexpended	$15,502.47
Amount appropriated by act of August 17, 1894	37,500.00
	53,002.47
June 30, 1895, amount expended during fiscal year	30,573.74
July 1, 1895, balance unexpended	22,428.73
July 1, 1895, outstanding liabilities	23.76
July 1, 1895, balance available	22,404.97
Amount (estimated) required for completion of existing project	233,250.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix I I 22.)

23. Operating and care of locks and dams on Fox River, Wisconsin.—Under the continuous appropriation for operating and care of canals and other works of navigation, it is proposed to maintain existing navigation by timely repairs to old locks until they are replaced by new and to continue repairs of works that have already been completed and used, injured by floods or otherwise.

During the fiscal year ending June 30, 1895, $40,438.60 has been expended, the detailed statement appended to the report of the local engineer officer showing the items of expenditure.

(See Appendix I I 23.)

24. Removing sunken vessels or craft obstructing or endangering navigation.— Wreck of schooner Kate Kelly, northeast of Racine, Wis.—This vessel lies sunken in the route of vessels running direct from Milwaukee to Chicago and is an obstruction to navigation. On June 4, 1895, its removal by the United States in accordance with law was authorized.

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An advertisement dated June 6, 1895, giving notice to parties interested in the wreck, has been published.

(See Appendix I I 24.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations of the following localities, required by the act of August 17, 1894, were made by the local engineer, Maj. James F. Gregory, and reports thereon submitted through the division engineer, Col. O. M. Poe, Corps of Engineers.

1. Preliminary examination of Oconto River, Wisconsin, to obtain a channel 16 feet deep and 150 feet wide.—Major Gregory submitted report of examination October 24, 1894. Work has been done under appropriations by Congress, looking to the improvement of harbor at Oconto, and Major Gregory reports that, considering its commercial importance, the locality, in his opinion, is not worthy of improvement by the General Government beyond the amount contemplated by the present approved project. His views are concurred in by the division engineer and by this office. The report was transmitted to Congress and printed in House Ex. Doc. No. 54, Fifty-third Congress, third session. (See also Appendix I I 25.)

2. Preliminary examination of Whitefish River, Michigan, for harbor at the mouth in Little Badenock Bay.—Major Gregory submitted report of examination October 22, 1894. In his opinion, concurred in by the division engineer and by this office, the locality in question is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 55, Fifty-third Congress, third session. (See also Appendix I I 26.)

IMPROVEMENT OF CHICAGO AND CALUMET HARBORS AND ILLINOIS RIVER, ILLINOIS, AND CALUMET RIVER, ILLINOIS AND INDIANA; ILLINOIS AND MISSISSIPPI CANAL.

This district was in the charge of Maj. W. L. Marshall, Corps of Engineers, having under his immediate orders Lieut. Henry Jervey, Corps of Engineers; Division Engineer, Col. O. M. Poe, Corps of Engineers.

1. Chicago Harbor, Illinois.—The present project was adopted in 1870 and contemplated—

a. The formation of an outer harbor or basin, by inclosing a portion of Lake Michigan just south of and adjoining the entrance to Chicago River, for the purpose of increasing the harbor facilities of Chicago.

b. The construction of an exterior breakwater in deep water north of the entrance to Chicago River and about 1 mile distant, to shelter the approach to the river and outer harbor entrance, and to form a harbor of refuge at the southern end of Lake Michigan.

The expenditures upon this project since 1870 have resulted in the completion of the outer harbor, except dredging still remaining to be done to attain 16 feet depth of water at low water throughout the required basin; in the completion of the exterior breakwater, 5,413 feet in length; in keeping the entrance to Chicago River, which constitutes the inner harbor of Chicago, dredged; in maintaining the various piers and breakwaters, and in maintaining in serviceable condition the plant pertaining to the work.

The piers at the entrance to Chicago River seaward of the shore line and of the outer basin are now practically new and in excellent condition, except over 500 linear feet of the southerly breakwater, which will soon need rebuilding. The older piers that are now within the shore

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line, due to natural and artificial accretions to the land, are in bad condition, and have been practically abandoned by the United States as forming part of the dockage of Chicago River, except that portion of the south pier forming the north limit of the Illinois Central Railroad docks.

Under the river and harbor act of August 17, 1894, a contract was entered into October 1, 1894, with the Fitz Simons and Connell Company, of Chicago, Ill., for rebuilding superstructure over 2,200 linear feet of the exterior breakwater, and for repairing the remainder of the superstructure over that breakwater, which had been seriously damaged by the great storm of May 18, 1894, as indicated in the last annual report on this work.

This contract also provides for a substantial decking over the entire pier.

The work of rebuilding the superstructure over the 2,200 linear feet has not been begun.

No dredging has been done during the year, but estimates have been made for a small amount necessary near the mouth of the river near the Illinois Central Railroad Bridge.

The outer basin continues to fill in and deteriorate. The dredging still to be done, estimated in 1887, when dredging operations had been suspended, at 267,000 cubic yards, now exceeds 500,000 cubic yards to give 16 feet below United States harbor datum and more than 1,400,000 cubic yards to secure 18 feet depth.

This work is not pressing, as the outer basin has never been used for commercial purposes to any extent, and the ultimate uses of this basin have never yet been determined.

With the exception of this dredging all of the work at Chicago Harbor has been completed, and the funds now on hand are probably sufficient for maintenance during the next year. No additional estimate is therefore submitted.

The entire question of the future extension, improvement, and uses of this harbor and its relation to the requirements of navigation and to local works awaits settlement by Congress.

Up to the close of the fiscal year ending June 30, 1895, there has been expended under the project of 1870, $1,716,263.61.

July 1, 1894, balance unexpended		$27,449.42
Amount appropriated by act of August 17, 1894		80,000.00
		107,449.42
June 30, 1895, amount expended during fiscal year		13,082.87
July 1, 1895, balance unexpended		94,366.55
July 1, 1895, outstanding liabilities	$100.00	
July 1, 1895, amount covered by uncompleted contracts	49,556.82	
		49,656.82
July 1, 1895, balance available		44,709.73

(See Appendix J J 1.)

2. Calumet Harbor, Illinois.—This improvement is to furnish a safe and practicable entrance to Calumet River and the port of South Chicago by parallel piers 300 feet apart, extending from shore to deep water in the lake, and by dredging between them to 16 feet in depth at low water.

The work commenced in 1870, and at the close of the fiscal year ending June 30, 1895, there had been expended $446,907.60, as the result of which 3,640 linear feet of the north pier and 2,020 linear feet of the

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south pier have been completed and 471,364 cubic yards of material dredged, giving a channel 16 feet in depth instead of 7 feet, as originally existed.

The channel is now 16 feet in depth below extreme low water in Lake Michigan, and extends from a similar depth in Lake Michigan to the beginning of the 16-foot channel in the Calumet River.

During the last fiscal year a contract, dated October 1, 1894, was entered into with the Fitz Simons and Connell Company, of Chicago, for rebuilding superstructure over 1,600 linear feet, more or less, of the north and south piers.

Upon the completion of the existing contract the piers will be in good condition, with the exception of about 437 linear feet east of the Illinois Steel Company's slip and the revetment of the north pier west of said slip, which, however, is now within the shore line.

The harbor is gradually shoaling up, which shoaling can be reduced in rapidity by the extension of the south pier.

The river and harbor act of 1894 authorized a "survey for further improvement if necessary." A survey was unnecessary, but a report and estimate is submitted looking to further improvement of the harbor.

An estimate for maintenance of existing work, including the repairs to superstructure, rebuilding the revetment of north pier, and dredging, is submitted.

This work, as far as projected, was completed in 1889, and all work since that date has been in the nature of repair and preservation of completed work.

July 1, 1894, balance unexpended	$6,137.70
Amount appropriated by act of August 17, 1894	15,000.00
	21,137.70
June 30, 1895, amount expended during fiscal year	5,645.30
July 1, 1895, balance unexpended	15,492.40
July 1, 1895, amount covered by uncompleted contracts	3,930.52
July 1, 1895, balance available	11,561.88
Amount (estimated) required for maintenance of existing works	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix J J 2.)

3. Calumet River, Illinois and Indiana.—The object of this improvement as far as projected is to secure a channel 200 feet in width and 16 feet in depth below low-water plane in Lake Michigan from the mouth of the Calumet River, at Calumet Harbor, Illinois, to one-half mile east of Hammond, Ind., with a view to increasing the facility for handling the commerce of this region, and also aid in providing means for the better accommodation of much of the commerce of Chicago River, which river is very much crowded. The original depth of navigation in this river varied from 6 to 10 feet.

The various acts of Congress and the limitations made by law upon the expenditure of the appropriations thereby made before work was systematically inaugurated upon this improvement are given in the Annual Report of the Chief of Engineers for the year ending June 30, 1889.

Since the beginning of the improvement there has been removed from "below the forks" 1,744,769 cubic yards of material, making a channel 3 miles and 3,378 feet in length, of which a short portion, where rock

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and other undredgable material was encountered, is incomplete, there remaining less than 9,000 cubic yards to be removed.

This material can be most economically removed after all of this class shall have been revealed by further work.

The amount expended by the United States to the close of the fiscal year ending June 30, 1895, is $279,842.11, of which $236,715.95 has been expended below the forks of the Calumet, including $5,000 paid for legal expenses in securing rights of way and releases from damages due to the proposed improvement, required by the act of July 5, 1884, and $43,126.16 for work between the forks of the Calumet River and one-half mile east of Hammond, Ind.

From the channel "above the forks" there has been dredged 248,516 cubic yards.

During the fiscal year ending June 30, 1895, the contract with W. A. McGillis & Co., for redredging near the mouth of the Calumet River, which work was in progress at the close of the last fiscal year, was completed, the total amount of material removed being 50,035.85 cubic yards, of which 20,945.85 cubic yards was removed during the previous fiscal year, but not paid for that year.

Under the river and harbor appropriation of August 17, 1894, under formal contracts for redredging the channel below the forks, 156,744 cubic yards was removed and the channel restored to its full depth for nearly two miles. Work is still in progress under this contract. Including the work done under the former contract, a total of 185,340 cubic yards was removed.

Above the forks.—A contract was entered into with McMahon & Montgomery, lowest bidders, for dredging this section of the work under the appropriation of August 17, 1894. One section of the channel, 640 linear feet, was completed and paid for, but after many attempts to gain the contracted-for depth of channel in a secured section without success on account of the continuous inflow of offal from the G. H. Hammond slaughterhouses, the Hirsch & Co. starch factory, and sewage deposits from Hammond, the contractors stopped work and applied to be relieved. By authority of the Secretary of War a supplementary agreement terminating the contract as impracticable of execution and providing for a settlement with the contractors was entered into May 5, 1895, and the contract closed.

It is impracticable to improve the upper section of this river at reasonable cost as long as the channel may be used as a dumping ground for the offal of slaughterhouses and manufacturing establishments, there being no current in this dead end of river.

The balance of the amount appropriated for this section can be advantageously used on the systematic improvement of the lower river now in progress, if authorized by Congress.

The rapid filling in of this river, even along the lower section, will necessitate frequent redredging. All the work executed during the past year has been for maintenance and restoration of channels previously dredged.

The improvement of the lower section of the river has resulted in attracting many enterprises of magnitude, the increase in number and tonnage of vessels seeking this region during the past season, as shown in the report for Calumet Harbor, over the previous year being 90 per cent in number and nearly 100 per cent in tonnage.

An accurate survey of this part of the river was made during the year.

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July 1, 1894, balance unexpended		$9,832.87
Amount appropriated by act of August 17, 1894		45,000.00
		54,832.87
June 30, 1895, amount expended during fiscal year		34,674.98
July 1, 1895, balance unexpended		20,157.89
July 1, 1895, outstanding liabilities	$150.00	
July 1, 1895, amount covered by uncompleted contracts	9,172.70	
		9,322.70
July 1, 1895, balance available		10,835.19

Amount (estimated) required for completion of existing project	700,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix J J 3.)

4. Illinois River, Illinois.—The present project was adopted in 1880, and contemplates the extension of the slack-water improvement begun by the State of Illinois, from the mouth of Copperas Creek to the Mississippi River, a distance of about 135 miles.

The project includes the construction of two locks 350 feet long between miter sills, 75 feet in width of lock chamber, with a depth of 7 feet of water over sills at low-water level of 1879, and dredging the channel where necessary to secure 7 feet depth of water at low water in the pools thus created.

The two locks and dams have been completed and are in use. They are situated, one at Kampsville, 31 miles above the mouth of the Illinois, the other at La Grange, 79 miles above the mouth of the river.

The ultimate object of the improvement is the construction of a waterway from the southern end of Lake Michigan to the Mississippi River of sufficient capacity to accommodate large-sized Mississippi River steamboats, and for military and naval purposes.

The State of Illinois, aided by the United States, has executed part of the project by the construction of two locks of the dimensions above stated, one at Henry and one at Copperas Creek, respectively, completing, excepting dredging, that part of the improvement between La Salle, Ill., and the mouth of Copperas Creek.

In executing this work the United States has expended, up to June 30, 1895, $1,306,722.36, including $25,000 from the appropriation of August 11, 1888, for surveys, and excluding $62,359.80 expended upon a foundation for Copperas Creek Lock, afterwards completed by the State of Illinois.

An additional amount of $747,747 was expended by the State of Illinois at Henry and Copperas Creek locks.

During the fiscal year ending June 30, 1895, the following work was done:

Dredging operations below Kampsville Lock were directed to securing a practicable channel 100 to 130 feet in width and 4 feet deep (to be afterwards deepened to 7 feet and widened to 250 feet) from Kampsville Lock to the Mississippi River at extreme low water, the natural depth being from 18 inches to 2 feet. One hundred and two thousand eight hundred and thirty-six cubic yards of material was dredged from below the lock and at Hurricane Island, French Bar, Guidford Bar, Macoupin Creek, Blooms Landing Bar, and Six Mile Island Bar. The 4-foot channel will be completed, if the dredges do not break down, before the close of the present working season, and navigation throughout the low-water season seems now assured.

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Two hundred and seventy snags were removed from the channel between Copperas Creek Lock and the Mississippi River.

Two lock houses were constructed at Kampsville Lock and one at La Grange Lock.

All the floating plant pertaining to this work except the dump scows recently built was repaired, but is so worn, rotten, and unserviceable that it can with difficulty be kept afloat. At the close of the present working season, if it can be kept at work so long, all this plant will be submitted to inspection for condemnation. It can no longer be made useful.

Two new dump scows, 100 cubic yards capacity each, were constructed.

The original project for this work and estimates made under it contemplated continuous work with sufficient means; instead the appropriations have been meager, and the work, prolonged so far over fifteen years, is still incomplete.

The balance of money still to be appropriated under the old project ($77,500) being insufficient to complete the dredging, an examination was made and a supplementary estimate completed and submitted to the Chief of Engineers June 11, 1895. This project was approved and authority given to submit an additional estimate of $319,500 to Congress, making in all, with unappropriated balance of former estimate, $397,000 required to complete the project.

July 1, 1894, balance unexpended	$7,093.52
Amount appropriated by act of August 17, 1894	35,000.00
	42,093.52
June 30, 1895, amount expended during fiscal year	27,442.67
July 1, 1895, balance unexpended	14,650.85
July 1, 1895, outstanding liabilities	2,500.00
July 1, 1895, balance available	12,150.85
Amount (estimated) required for completion of existing project	397,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix J J 4.)

5. Operating and care of La Grange and Kampsville locks and dams, Illinois River.—These locks and dams have been maintained and operated under the general indefinite appropriation "for operating and care of canals and other works of navigation" contained in section 4 of the river and harbor act of July 5, 1884.

La Grange Lock.—This lock was maintained and operated during the season of navigation. The drift was kept cleared from the dam. The lock house, ice breakers, and gates were painted, the temporary buildings and fences whitewashed, the grounds leveled, and the gates calked. Two hundred shade trees were planted and the ice house filled with ice.

Flush boards were placed on the dam when required at low water and damages to the gates by collision repaired.

Kampsville Lock.—This lock was also maintained and operated during the season of navigation. A pile revetment 150 feet long was built below the land wall, 4 clumps of 7 piles each were driven above the lock on the land side to serve as guides and fenders, 140 cubic yards of riprap was placed back of the revetment below the dam abutment and around the lower spur platform, 30 tons of ice put up, a canvas roof put on the shop, and the shop gates and ironwork painted.

Flush boards 12 inches high were placed on the dam at low water.

Damages by collision to gates were repaired.

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The passages at La Grange of steamers and barges increased in number from 210 in 1890 to 625 in 1895; in tonnage from 54,310 tons in 1890 to 137,344 tons in 1895.

At Kampsville from 297 steamers and barges in 1894 to 632 in 1895; from 108,444 tons in 1894 to 180,912 in 1895.

The amount expended during the fiscal year 1895 was, for both locks, $14,851.60, including $862.91 liabilities at end of fiscal year.

(See Appendix J J 5.)

6. Illinois and Mississippi Canal, Illinois.—The object of this improvement is to furnish a link in a navigable water route from Lake Michigan at or near Chicago, Ill., to the Mississippi River at the mouth of Rock River.

The canal is located upon the route approved by the Secretary of War October 27, 1888, from the Illinois River, about 1⅜ miles above the town of Hennepin, at the great bend of the Illinois River; thence via Bureau Creek Valley to Rock River at Penney Slough; thence by slack water and a short canal around the lower rapids of Rock River to its mouth. The canal is to be 80 feet wide at the water surface, 7 feet deep, and with lock chambers 170 feet in length and 35 feet in width.

A report upon the detailed location and estimates for the construction of this canal was submitted June 21, 1890, and published by Congress as House Ex. Doc. No. 429, Fifty-first Congress, first session.

The river and harbor act of September 19, 1890, made the first appropriation for the construction of this canal, and directed work to be begun by the construction of one of the locks and dams on Rock River.

Work was commenced on this canal in July, 1892, near the mouth of Rock River, and since that date has been prosecuted. There has been expended on this work up to the close of the fiscal year ending June 30, 1895, $810,960.22, which has resulted in—

(1) The acquirement of the right of way for 4½ miles around the lower rapids of Rock River and the completing of the work there, with the exception of dredging at the mouth of the canal, involving the construction of 4½ miles of canal, 3 locks, 1 railroad and 2 highway movable bridges, 7 sluices, 1 arch culvert, 2 dams across arms of Rock River, and 3 lock houses.

(2) In the location on the ground and the preparation of plats and descriptions of all lands needed for the eastern section as far as to the feeder junction and in acquiring the right of way by condemnation of the title to the first 8 miles thereof.

(3) In the survey of a new route from the feeder junction to Rock River and the preparation of estimates along that line.

(4) In the survey (nearly completed) of two lines for the feeder, one from near Dixon, Ill., and the other from near Sterling, Ill.

(5) In placing under contract and near completion of 8 miles earthwork of the eastern section of the canal and the foundations of 7 locks.

(6) In the completion of 3 arch culverts and 3 pipe culverts on eastern section.

During the past fiscal year the following work has been done:

Western section.—The canal around the lower rapids of Rock River was completed, except some dredging and revetment filling at the mouth of the canal, and the canal opened for navigation April 17, 1895. The work consisted in the completion of the dams across Rock River, 1,362 feet in length; the construction and hanging of gates for Lock 37; back filling behind the locks placed; the construction of 2 metal bridges, piers and abutments, and 1 pontoon bridge; the construction of 3 lock keepers' houses; the removal of cofferdams and cross banks; the construction of retaining walls at bridges and below dams and pile revetments at Locks 36 and 37, and the completion and riprapping of the canal banks and approaches to the sluiceways, and in transferring property and plant to the eastern section.

This section is in fine condition throughout; has been constructed within the estimates made therefor, and is in use, but its utility is

limited to excursion and passenger craft until the bridges across Rock River can be modified to allow access to the coal fields above.

Feeder line.—Two lines were surveyed for the feeder, one from near Sterling, Ill., with the object in view to cut down the summit level 9 feet and shorten the feeder and reduce the number of locks by 3, and the other over practically the route reported upon in June, 1890, which leaves Rock River near Dixon, Ill. The maps and estimates of these surveys are in progress; when completed the feeder will be definitely located.

Eastern section.—Contracts were made for 8 miles of canal trunk and the foundation of 7 locks. Of this work 4 miles of canal trunk and 4 of the lock foundations were completed during the year, and the rest of the work well advanced.

Three 10-foot arch culverts and 3 pipe culverts were completed by hired labor; also the masonry of Lock 5. The forming for Lock 2 was completed ready for deposit of concrete masonry; 5 miles of narrow-gauge track laid; 6 warehouses, 1 highway bridge, and three-fourths mile of bank revetment constructed. A gravel pit was stripped, and foundation pits for arch culverts 1 and 2 excavated.

All earthwork and foundations will be completed by September 30, 1895, and it is expected that the 7 locks and 5 arch culverts, and also the masonry for 1 aqueduct, will be completed by the close of the present season.

Contracts have been made for all material required for this masonry, and much of it is on hand.

The estimate for the first 8 miles of canal, made in 1890, was $781,514. There has been available for construction about $500,000, including amounts now available, so that this section of 8 miles can not be completed without further appropriations.

July 1, 1894, balance unexpended		$540,916.61
Amount appropriated by act of August 17, 1894		190,000.00
		730,916.61
June 30, 1895, amount expended during fiscal year		351,090.37
July 1, 1895, balance unexpended		379,826.24
July 1, 1895, outstanding liabilities	$143,152.58	
July 1, 1895, amount covered by uncompleted contracts	64,033.37	
		207,185.95
July 1, 1895, balance available		172,640.29
Amount (estimated) required for completion of existing project		5,735,960.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		150,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix J J 6.)

7. Operating and care of Illinois and Mississippi Canal; canal around Lower Rapids of Rock River at Milan, Ill.—This canal is 4½ miles in length, and the works to be operated are 3 locks, 2 swing bridges, and 7 Taintor sluice gates.

The canal was formally opened to navigation on April 17, 1895, and it has been operated and maintained since that date, but passages of vessels through it have been limited to daytime.

On account of three fixed bridges across Rock River a few miles above the head of this canal the traffic of the canal has been confined to passenger and excursion craft. Steps have been taken to have a draw put in the first of these bridges, owned by the city of Moline, but the authority of the Secretary of War is denied by the city of Moline.

During the season of navigation the following traffic was carried on through the canal:

Traffic on western section Illinois and Mississippi Canal, April 17 to June 30, 1895, inclusive.

Steamboats	number..	24
Barges	do....	9
Tonnage, steamers	tons..	858
Tonnage, barges	do....	679
Passengers	number..	3,539
Freight	tons..	6

NOTE.—Not included in the above is 3,355 tons of stone carried by barge and used in riprapping banks.

The total amount expended during the fiscal year ending June 30, 1895, was $510, including $255 outstanding liabilities.

(See Appendix J J 7.)

SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The survey of *Calumet Harbor, Illinois*, required by the act of August 17, 1894, was made by the local engineer, Maj. W. L. Marshall, Corps of Engineers, and his report thereon, dated June 30, 1895, was submitted through the division engineer, Col. O. M. Poe, Corps of Engineers.

Major Marshall submits a project for the further improvement of the existing harbor by the extension of the present north and south piers 500 feet and 1,200 feet, respectively, at a total estimated cost of $154,550.

(See Appendix J J 8.)

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN MICHIGAN AND OF MICHIGAN CITY HARBOR, INDIANA.

This district was in the charge of Lieut. Col. G. J. Lydecker, Corps of Engineers.

1. Michigan City Harbor, Indiana.—The improvement of this harbor dates from 1836, and has resulted in establishing a convenient "inner harbor" for local commerce, and partly completing an "outer harbor" designed to facilitate entrance to the former, and afford refuge in times of northerly gales to vessels engaged in general lake commerce.

The *inner harbor* has been made by (1) deepening the entrance to Trail Creek and protecting the channel by piers extending to deep water in Lake Michigan, to which operations were limited until 1870, and (2) prolonging the entrance channel up the creek by dredging between revetments that are built on established dock lines at the expense of the adjoining property, as required by city ordinance. This work, commenced in 1882 and still in progress, has thus far resulted in an interior waterway over 7,000 feet long between substantial revetments from 125 to 175 feet apart, with turning basins about 350 feet wide at suitable intervals. A further extension of 1,300 feet is required to complete as now proposed. The cost of all work done in connection with the "inner harbor," from 1836 to June 30, 1894, was $406,251.38.

The amount spent during the last fiscal year was $4,513.41. This was applied to dredging for maintaining the requisite navigable depth, the amount dredged being 25,582 cubic yards, resulting in the removal of all shoals and providing a full 13-foot channel throughout the limits of the interior improvement, and a depth of 16 feet in the entrance channel.

The principal requirements for maintaining this harbor are dredging and repairs to old piers at entrance. The section of the old east pier beyond the shore line has hardly any timber work left above the water line, and for a length of about 114 feet its top is several feet below water. The filling of the old west pier for a distance of 500 feet has

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gone to below the water surface. This section comprises the most exposed part of the work and should be refilled.

July 1, 1894, balance unexpended	$5,512.54
Amount appropriated by act of August 17, 1894	10,000.00
	15,512.54
June 30, 1895, amount expended during fiscal year	4,513.41
July 1, 1895, balance unexpended	10,999.13
July 1, 1895, outstanding liabilities	285.91
July 1, 1895, balance available	10,713.22
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	5,000.00

The outer harbor.—This comprises an outer basin of some 40 acres, located to the east of the entrance to the inner harbor, and an exterior detached breakwater to the westward, designed to give increased safety to vessels entering during heavy weather. The combination, when completed, is intended to provide a safe "harbor of refuge" against northerly gales for general commerce. The structures inclosing the basin comprise a pile pier 1,225 feet long, a crib breakwater 30 feet wide and 1,215 feet long, and a breakwater pier 30 feet wide and 500 feet long; in all, 2,940 feet. These were completed from 1870 to 1885, and expenditures applied thereto since that time have been for repairs simply.

The "exterior breakwater," projected in 1882 and now under construction, lies in the open lake westward of all other harbor works, and when completed will have a total length of 2,000 feet, comprised in two equal arms, making an interior angle of 130° with each other. One-half of the easterly arm had been completed to June 30, 1894. The total expenditures to that date for all work applied to constructing the outer harbor was $722,625.01. Expenditures during the past fiscal year were $4,595.70, most of which was applied to contract work for adding 200 feet to the length of the exterior breakwater; in addition considerable repairs were made to the "breakwater pier" and older parts of the exterior breakwater.

The construction of the combination of works that are designed to constitute the outer harbor has been in progress twenty-three years, and it is impossible for any considerable advantage to local commerce or increased safety to general commerce to be realized until all shall be completed. The importance of a harbor of refuge in this part of Lake Michigan is well recognized.

July 1, 1894, balance unexpended		$33,845.69
Amount appropriated by act of August 17, 1894		20,000.00
		53,845.69
June 30, 1895, amount expended during fiscal year		4,595.70
July 1, 1895, balance unexpended		49,249.99
July 1, 1895, outstanding liabilities	$695.50	
July 1, 1895, amount covered by uncompleted contracts	24,669.22	
		25,364.72
July 1, 1895, balance available		23,885.27
Amount (estimated) required for completion of existing project		229,613.50
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		95,000.00

(See Appendix K K 1.)

2. St. Joseph Harbor, Michigan.—The outlet of St. Joseph River into Lake Michigan was originally by a shifting channel, with depths fluc-

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tuating between 3 and 7 feet. Its improvement by the Government has extended through a period of fifty-nine years and expenditures for that purpose amounted to $432,814.02 up to June 30, 1894. The total estimated cost of the improvement, when completed as proposed by the revised project of 1892, is $519,113.

The objects sought by the present project are an entrance channel 270 feet wide and 16 feet deep, the extension ot the same depth through the harbor, and an interior navigation 13 feet deep from there to Benton Harbor, nearly 1 mile above. The interior navigation is maintained as required by frequent dredgings. The proposed entrance depth of 16 feet has not yet been obtained because of insufficent pier extension, and the actual depth there available generally varies from 14 to 15 feet.

The amount expended during the past fiscal year was $8,552.98. This was applied to dredging the channel from the harbor's entrance up to Benton Harbor and to repairing a break in the old north pier near the shore line. The amount of material dredged during the year was 91,213 cubic yards.

July 1, 1894, balance unexpended	$298.18
Amount appropriated by act of August 17, 1894	30,000.00
	30,298.18
June 30, 1895, amount expended during fiscal year	8,552.98
July 1, 1895, balance unexpended	21,745.20
July 1, 1895, outstanding liabilities	1,586.90
July 1, 1895, balance available	20,158.30
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	30,000.00

(See Appendix K K 2.)

3. St. Joseph River, Michigan.—The approved plan of improvement concerns the stretch of river from its mouth at St. Joseph Harbor to Berrien Springs, 25 miles above. It provides for the removal of sunken logs and snags, closing secondary channels by dams of brush and stone and wing dams at other points as found necessary, to concentrate the flow of water and maintain a low-water navigation of 3 feet depth over the obstructing bars and shoals. The original estimate of cost of improving this section of the river so as to give it a navigable depth of 3 feet was $11,300.

The amount expended to June 30, 1894, was $4,129.24. The channel has thereby been increased from its original depth of about 2 feet to a depth of 3 feet at most of the worst places; but other shoal places remain, and the structures already placed, having necessarily been of a light and inexpensive character, are in need of repairs. Expenditures during the past fiscal year were $394.10; they were applied to repairing seven of the old dams and lengthening two of them 25 feet each and building three new ones of brush and stone, aggregating about 330 feet in length.

July 1, 1894, balance unexpended	$370.76
Amount appropriated by act of August 17, 1894	500.00
	870.76
June 30, 1895, amount expended during fiscal year	394.10
July 1, 1895, balance unexpended	476.66
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	500.00

(See Appendix K K 3.)

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4. South Haven Harbor, Michigan.—Before improvement by the General Government, the citizens of South Haven had constructed piers and revetments at the mouth of Black River and thereby obtained a channel into Lake Michigan 6 or 7 feet deep and 85 feet wide. The improvement thus started was taken up by the Government in 1867, under a plan of operations that provided for increasing the channel to a width of 120 feet between piers extended far enough into Lake Michigan to obtain and hold a navigable depth of 12 feet. The original project was subsequently modified to make the entrance width between piers 177 feet, and extend the navigable channel upstream to the highway bridge about half a mile above the piers. The total length of piers and revetments built up to the year 1888 aggregated 3,145 feet, and no extensions have been made to them since that time.

The estimated cost of all work done, and to be done under the present approved project, is $262,000. The total expenditure to June 30, 1894, was $216,731.06, resulting in the construction and maintenance of piers and revetments indicated in the foregoing paragraph, and in repeated dredgings to provide the requisite channel depth.

The amount expended during the past fiscal year was $1,893.82—all for minor repairs to old piers, and to repairs of dredging plant belonging to the Government and used in this district. Money now on hand will be applied to dredging the harbor, rebuilding about 875 feet of north pier above water, and minor repairs of other parts of old pier work.

To gain the object of the project of improvement adopted for this harbor—i. e., to provide and keep a reliable navigable channel 12 feet deep—it is necessary that the piers be extended to a depth of 15 feet in Lake Michigan, which will require additions of 250 and 450 feet to the north and south piers, respectively; the last approved project authorizes extensions aggregating only half that amount.

July 1, 1894, balance unexpended	$268.94
Amount appropriated by act of August 17, 1894	20,000.00
	20,268.94
June 30, 1895, amount expended during fiscal year	1,893.82
July 1, 1895, balance unexpended	18,375.12
July 1, 1895, outstanding liabilities	167.21
July 1, 1895, balance available	18,207.91
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	10,000.00

(See Appendix K K 4.)

5. Saugatuck Harbor, Michigan.—This harbor is at the mouth of the Kalamazoo River, where the channel depth before improvement was generally not over 5 feet; its condition was first improved by a private company, which built two slab piers for confining the river current, and thereby obtained a channel depth of 7 feet temporarily. Its further improvement was commenced by the General Government in 1869, and from that time to 1882 the piers were extended and interior channel revetments constructed until they had a total length of 1,907 feet on the north and 3,863 feet on the south side, all of pile work. Since 1882, appropriations having been too small to keep these structures in repair, they have gradually gone to decay, and the navigable channels opened through the harbor from time to time, by dredging, fill up again very soon after the departure of the dredge.

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The estimates made for carrying on the work from time to time aggregated $175,699.46, and the total expenditure to June 30, 1894, was $145,430.15, with results as indicated in the foregoing paragraph.

The amount expended during the past fiscal year was $4,826.48, applied to dredging 40,000 cubic yards.

When this work of dredging commenced the channel depths at entrance and over interior shoals were only from 5 to 7 feet, and the result of operations covering the period between May 23 and October 21, 1894, was to increase these depths to 10 or 12 feet through a narrow channel, thereby opening the harbor for navigation during the most busy period, but the channel closed again soon after the work of dredging was stopped.

If there be any intention to maintain this as a navigable harbor, a general reconstruction of existing structures is necessary. If the establishment of a navigable depth of 12 feet, as heretofore contemplated, is to be accomplished, the old works must be put in serviceable condition as above indicated, and both piers extended to the curve of 15-foot depth in Lake Michigan, now distant 1,000 feet and 800 feet from the north and south pier ends, respectively. No estimate for the above work is submitted for the reason that there is no present authority for undertaking it.

July 1, 1894, balance unexpended	$8.85
Amount appropriated by act of August 17, 1894	12,000.00
	12,008.85
June 30, 1895, amount expended during fiscal year	4,826.48
July 1, 1895, balance unexpended	7,182.37
July 1, 1895, outstanding liabilities	14.36
July 1, 1895, balance available	7,168.01
Amount (estimated) required for completion of existing project	18,260.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix K K 5.)

6. Holland (Black Lake) Harbor, Michigan.—The first steps toward establishing a harbor at this place were taken by the citizens of Holland, Mich., situated on Black Lake, about 5 miles from the present harbor, by opening a channel having a navigable depth of about 5 feet from the lake into Lake Michigan, and protecting it by piers and revetments made of brush and stone. Continuation of this improvement was taken in hand by the General Government in 1867, existing structures strengthened by pile and crib work, and extended until, in 1880, the north side pier and revetment had attained a total length of 850 feet and the south side 1,675 feet; they have remained without extension since that time.

The estimated cost of work done, and remaining to be done, to complete the present approved project, was $291,615.13, and the amount expended to June 30, 1894, was $276,883.33. The results thereby attained have been the construction and maintenance of piers and revetments aggregating 35,525 feet in length, covering a channel way from 175 to 220 feet wide, in which a depth of 8 to 9 feet prevails, deepened by occasional dredging to 12 or 13 feet. The dredged channels have but little permanence because the piers are not long enough, and the older portions of them are in such condition as to permit the passage of large quantities of sand through and under them, by which the clear way between them soon fills to a general depth of 8 or 9 feet only.

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Expenditures during the past fiscal year were $4,689.20; they resulted in keeping the harbor open to navigation by dredging during the busy season, and making temporary repairs of a breach in the south pier that occurred late in the fall of 1894, and threatened a complete blockade of the harbor.

The proposed depth of 12 feet can not be maintained until the old piers are strengthened and sheet-piled to make them sand tight, and extended to the 15-foot curve in Lake Michigan; such extension will require an addition of 400 feet to each, but it is not yet authorized.

July 1, 1894, balance unexpended	$2,730.79
Amount appropriated by act of August 17, 1894	15,000.00
	17,730.79
June 30, 1895, amount expended during fiscal year	4,689.20
July 1, 1895, balance unexpended	13,041.59
July 1, 1895, outstanding liabilities	2,033.83
July 1, 1895, balance available	11,007.76
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix K K 6.)

7. *Grand Haven Harbor, Michigan.*—This harbor is at the mouth of the Grand River, which had a shifting channel, with a depth of 9 feet at its mouth, before improvement. The first step in the line of improvement was taken by the Detroit, Grand Haven and Milwaukee Railroad Company, by constructing a pier on the south side to provide for the interchange of traffic between the railroad and its transLake line of steamers. Its systematic improvement was commenced by the Government in 1867 and has resulted in the establishment of a harbor that not only satisfies the needs of an extensive local commerce, but gives to general commerce its only harbor of refuge from westerly gales on this coast south of Grand Traverse Bay. This important quality is due to the established width of 400 feet between the piers at entrance and the maintenance there of a channel depth of about 18 feet.

The estimated cost of the work done and remaining to be done to complete the harbor, as provided in the approved project, amounts to $804,366.15, and the total expenditures thereon to June 30, 1894, were $668,529.52.

The works of improvement thereby built and kept in repairs comprise a north pier and revetment aggregating 3,187 feet in length, projecting 1,215 feet beyond the shore line, and a south pier and revetment 5,576½ feet long, projecting 1,560 feet beyond the adjacent shore line.

Expenditures during the last fiscal year were $44,790.98, resulting in an extension of 350 feet to the north pier and in some considerable repairs of old pier work.

The depths of water at the close of the year were 17½ feet at entrance between piers, 21 feet in southerly channel of approach, 19 feet in the northerly one, and a least depth of 14.1 feet on the middle ground between them, immediately in front of the harbor entrance.

The formation of the shoal in front of the entrance is the principal difficulty that has to be contended with in the improvement of this harbor; pier extension alone will not solve the problem. The principal element that contributes to its formation is the sand blown into the harbor from the adjoining uncovered sand dunes, and then carried by

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the body of water flowing out of Grand River, through the contracted waterway between the piers, until the current is checked on spreading into Lake Michigan and no longer able to uphold its load of sand; it then falls to the lake bed and goes toward the upbuilding of the shoal. The remedy is to cut off the supply of sand by a growth of vegetation on the dunes, adjoining the harbor, and supplement this with a suitable combination of sand fences. With this done, and the piers extended as required by the present approved project, a channel depth of full 18 feet at entrance may be counted upon. Nothing less will satisfy the important requirement of making this a safe harbor of refuge. The older pile structures are in need of considerable repairs and much additional filling.

July 1, 1894, balance unexpended	$45,836.63
Amount appropriated by act of August 17, 1894	25,000.00
	70,836.63
June 30, 1895, amount expended during fiscal year	44,790.98
July 1, 1895, balance unexpended	26,045.65
July 1, 1895, outstanding liabilities	655.50
July 1, 1895, balance available	25,390.15
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	25,000.00

(See Appendix K K 7.)

8. Muskegon Harbor, Michigan.—The first improvements at this place were made at local expense, by constructing slab piers and revetments, so as to afford entrance from Lake Michigan to Muskegon Lake for vessels drawing 7 feet. The work was taken in hand by the Government in 1867; old piers were remodeled and extended across the bar at entrance, channel dredged, and a through depth of 12 feet obtained. Thereafter the piers were prolonged as necessitated by the steady lakeward progress of the shore line and sand deposits in advance of it, and a fair 12-foot channel thereby maintained, but the clear way between piers was only 180 feet, making entrance dangerous in stormy weather. After 1882 this difficulty was remedied by building extensions of the north pier on a line 300 feet from the south pier, and connecting the old and new lines by an oblique wing of crib work 330 feet long. In 1892 the project of improvement was amplified and defined with a view to securing and maintaining a navigable depth of 15 feet; its estimated cost was $260,000. Prior to the adoption of this modified project operations had been carried on under appropriations made from time to time in such sums as were called for to meet immediate necessities, but without defined estimates of ultimate cost. The expenditures for work so done amounted to $262,914.18.

The total of expenditure to June 30, 1894, was $402,461.38, when the north pier and revetment had a completed length of 2,582.4 feet and the south pier 1,482.5 feet; the available channel depth was 13 feet.

Expenditures during the last fiscal year were $6,653.94; they were applied to miscellaneous repairs of piers and dredging plant, and to dredging; in the latter work 10,708 cubic yards was excavated and a narrow channel, with a navigable depth of 15½ feet, thereby obtained temporarily.

For obtaining and keeping the proposed depth of 15 feet the piers must be prolonged to the full length called for by the present approved

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project, which requires extensions of 550 and 500 feet for the north and south piers, respectively.

July 1, 1894, balance unexpended	$1,538.62
Amount appropriated by act of August 17, 1894	30,000.00
	31,538.62
June 30, 1895, amount expended during fiscal year	6,653.94
July 1, 1895, balance unexpended	24,884.68
July 1, 1895, outstanding liabilities	1,303.51
July 1, 1895, balance available	23,581.17
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	30,000.00

(See Appendix K K 8.)

9. White Lake Harbor, Michigan.—The improvement at this point contemplates the creation and maintenance of a channel 200 feet wide and 12 feet deep between revetments and piers extending to deep water in Lake Michigan, thereby providing easy entrance to White Lake. Before improvement the two lakes were connected by a narrow and winding stream with a navigable capacity of only 5 feet. The estimated cost of the improvement was originally $170,530.80, subsequently increased by additional projects of 1873, 1884, and 1892 to $337,550.

The total expenditure to June 30, 1894, was $274,835.08, and the harbor works then comprised a north pier 1,515 feet long projecting into Lake Michigan 390 feet beyond its shore line, and a south pier 1,854 feet long projecting 730 feet beyond the shore line. The available depth at entrance was 10½ feet. The proposed depth of 12 feet has been obtained from time to time by dredging, but the channel so made soon shoals again to 9 or 10 feet, and this will continue to be the condition of affairs until the piers have been carried to the curve of 15 feet depth in Lake Michigan, now distant about 550 and 250 feet from the ends of the north and south piers respectively.

The amount expended during the last fiscal year was $706.55, applied to minor repairs of old pier work.

July 1, 1894, balance unexpended	$4,714.92
Amount appropriated by act of August 17, 1894	5,000.00
	9,714.92
June 30, 1895, amount expended during fiscal year	706.55
July 1, 1895, balance unexpended	9,008.37
July 1, 1895, outstanding liabilities	111.74
July 1, 1895, balance available	8,896.63
Amount (estimated) required for completion of existing project	53,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	2,500.00

(See Appendix K K 9.)

10. Pentwater Harbor, Michigan.—Originally an unnavigable connection existed between Lake Michigan and Pentwater Lake, which had

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been improved by local interests so as to afford a narrow 4-foot channel at the time the Government work was commenced in 1867. The project of improvement then adopted and followed without modification until the present time aimed to increase the channel depth to 12 feet and maintain it between revetments and piers extending into Lake Michigan; its estimated cost was $327,713.40.

The total expenditure to June 30, 1894, was $234,162.38. The length of north pier and revetment was 2,223 feet and of south pier 2,115 feet.

Expenditures during the past fiscal year amounted to $1,125.63, all applied to miscellaneous repairs of old piers and maintenance of the dredging plant belonging to this district.

The present piers reach to but little beyond the 10-foot curve in Lake Michigan, and for this reason a greater navigable depth can not be kept, except as dredging serves to give it temporarily; 12 feet, as called for by the approved project, can be obtained and held with any reasonable permanence only when the piers shall have been extended to the 15-foot curve, now from 300 to 400 feet distant. As matters now are, no matter how deep a channel may be made by dredging, it rapidly shoals to a depth of 9 or 10 feet only. The limit of extension at present authorized is 200 feet for the south and nothing for the north pier. The old portions of both piers must be rebuilt above water.

July 1, 1894, balance unexpended	$4,657.62
Amount appropriated by act of August 17, 1894	5,000.00
	9,657.62
June 30, 1895, amount expended during fiscal year	1,125.63
July 1, 1895, balance unexpended	8,531.99
July 1, 1895, outstanding liabilities	122.06
July 1, 1895, balance available	8,409.93
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	2,500.00

(See Appendix K K 10.)

11. Ludington Harbor, Michigan.—Before the Government undertook any work for improving this harbor local enterprise had made a narrow 7-foot channel from Lake Michigan to Pere Marquette Lake, and maintained it for several years. The Government work was commenced in 1867, with the purpose of enlarging the channel to a width of 200 feet and depth of 12 feet and protecting it by piers projecting into Lake Michigan. The estimated cost was $270,682. The improvement was duly made, and subsequently maintained by periodical dredging and pier extensions. In 1890 the scope of the design was enlarged and 18 feet was fixed upon as the depth to be obtained, thereby necessitating extensions of 500 and 700 feet to the north and south piers, respectively. It was further designed that these extensions should be so made as to increase the width at entrance to 250 feet. These extensions have been so made, but the full depth of 18 feet has not yet been realized. The total of expenditures on the original and modified projects to June 30, 1894, was $355,518.93, resulting in a reliable 14½-foot channel, protected between piers aggregating 3,833 feet in length.

The amount spent during the last fiscal year was $1,596.82, applied mainly to dredging and repairs of dredging plant. The amount dredged

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was 26,489 cubic yards, by which the depth of channel was temporarily increased to 16½ feet.

Further extension of piers is not required at present.

July 1, 1894, balance unexpended	$1,915.17
Amount appropriated by act of August 17, 1894	6,000.00
	7,915.17
June 30, 1895, amount expended during fiscal year	1,596.82
July 1, 1895, balance unexpended	6,318.35
July 1, 1895, outstanding liabilities	625.36
July 1, 1895, balance available	5,692.99
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	6,000.00

(See Appendix K K 11.)

12. Manistee Harbor, Michigan.—The commerce of this harbor is extensive and continuous throughout the year, its most prominent feature being the regular traffic of the steamers run by the Flint and Pere Marquette Railway Company, the largest of which draws 15 feet when loaded. The number of vessels entered and cleared during the year 1893 was 2,831, with a tonnage of 959,550; the receipts and shipments during the same period were 968,135 tons, the principal items of which were salt and lumber.

Before the Government undertook any work at this place local enterprise had opened an entrance to the river for vessels drawing 7 feet. Systematic work was commenced by the Government in 1867, under a project for pier construction and dredging, with a view to forming and maintaining a navigable channel 12 feet deep at the entrance to and between the piers; the project was extended in 1873 to include dredging in the river for a distance of about 1,350 feet inside the shore end of piers and to constructing revetments along the line of channel so dredged. In 1890 the scope of operations was again extended to include dredging a channel 15 feet deep throughout the length of the Manistee River, a distance of about 8,000 feet, from Lake Michigan to Lake Manistee, and to extending the north and south piers, respectively, to the 18 and 14 foot curves in Lake Michigan, with a view to maintaining that depth of channel at the entrance. The river channel was dredged through in 1891, but soon shoaled again to 13 feet because of the unprotected banks. Congress thereupon made further work in the river to depend upon the construction and maintenance of proper bank protection, and the work now in hand is limited to extending the piers above indicated, keeping them in serviceable condition and dredging between them.

The amount expended for these improvements to June 30, 1895, was $347,837.18. No work was done at the harbor during the year, expenditures made being for the harbor's proportionate share of making repairs to the general dredging plant belonging to the district, and contingencies of supervision, office expenses, etc.

The north and south piers, with the revetments connected therewith, have at this time lengths of 2,906½ feet and 1,689 feet, respectively, the channel depth between them being 14 feet; an extension of 350 feet to the south pier remains to be made to complete that structure.

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July 1, 1894, balance unexpended	$2,334.92
Amount appropriated by act of August 17, 1894	12,000.00
	14,334.92
June 30, 1895, amount expended during fiscal year	2,172 10
July 1, 1895, balance unexpended	12,162.82
July 1, 1895, outstanding liabilities	495.94
July 1, 1895, balance available	11,666.88
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	15,000.00

(See Appendix K K 12.)

13. Harbor of refuge at Portage Lake, Manistee County, Mich.—The great need of a harbor of refuge in this vicinity has long been recognized, and the peculiar adaptability of Portage Lake led to its selection for this purpose as far back as 1878. In 1879 Congress made the first appropriation for the work, but its amount, $10,000, was wholly inadequate for the object in view, and the subsequent appropriations have been insufficient to complete the work. Their expenditure has not produced results of any practical value; the piers have only reached to about half the proposed limits, and are wholly useless as a protection for any channel that may be made between them. The available depth between piers in April, 1894, was only 5½ feet. A channel 40 feet wide and 15 feet deep was dredged April 28 to May 26, to afford relief to the little local commerce, the amount excavated for this purpose being 24,870 cubic yards. In one month's time the dredged channel had shoaled again to an available depth of only 11 feet.

The total expenditure to June 30, 1895, was $99,569.10, of which $1,248.97 was expended during the last fiscal year.

July 1, 1894, balance unexpended	$2,179.87
Amount appropriated by act of August 17, 1894	25,000.00
	27,179.87
June 30, 1895, amount expended during fiscal year	1,248.97
July 1, 1895, balance unexpended	25,930.90
July 1, 1895, outstanding liabilities	164.35
July 1, 1895, balance available	25,766.55
Amount (estimated) required for completion of existing project	142,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	15,000.00

(See Appendix K K 13.)

14. Frankfort Harbor, Michigan.—Before any work was done by the Government, Lake Aux Becs Scies (Frankfort) could be entered from Lake Michigan by a narrow and uncertain channel 3 or 4 feet deep. The project adopted on commencing improvements in 1867 was to dredge a new connecting channel 12 feet deep and 200 feet wide, and to protect its sides by pile revetments and its entrance by crib piers extending 672 feet into Lake Michigan on the north side and 832 feet on the south side. The estimated cost was $146,400. This project was afterwards modified from time to time to provide for repairs, dredging, and

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necessary pier extension, until that now in progress, adopted in 1892, by which the crib work in north pier will be 1,002 feet long and in south pier 1,250 feet long. The original estimate has thereby grown to $325,659.85 as the total estimated cost of original construction, maintenance, and repairs, and new work included in the present project.

Up to the close of the fiscal year ending June 30, 1895, total expenditure was $277,189.19, of which $3,279.36 was expended during the last fiscal year. The latter was applied to dredging, repairs of dredging plant, minor repairs and to commencing the work of pier extensions for which appropriation was provided in the river and harbor act of August 17, 1894. Contract for the latter work was made April 18, 1895, providing for adding 400 feet to the north pier and 200 feet to the south pier.

The next appropriation should provide for repairing and refilling the old piers and for dredging the channel way between them. For these purposes the following estimate is submitted for 1897: Repairing and refilling old piers, $5,000; dredging, $4,000; total, with contingencies, $10,000.

July 1, 1894, balance unexpended		$4,028.52
Amount appropriated by act of August 17, 1894		50,000.00
		54,028.52
June 30, 1895, amount expended during fiscal year		3,279.36
July 1, 1895, balance unexpended		50,749.16
July 1, 1895, outstanding liabilities	$1,396.20	
July 1, 1895, amount covered by uncompleted contracts	31,782.99	
		33,179.19
July 1, 1895, balance available		17,569.97
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		10,000.00

(See Appendix K K 14.)

15. Charlevoix Harbor, Michigan.—The improvements at this place are designed to furnish access to Round and Pine lakes, situated in the northern part of the peninsula between Grand and Little Traverse bays. The original outlet from these lakes to Lake Michigan was a narrow stream through which boats drawing only 2 or 3 feet could pass. Local enterprise improved these conditions by dredging and pier construction so as to permit the passage of vessels drawing 6 feet. Work was then commenced by the Goverment with an appropriation of $10,000, made in the river and harbor act of August 14, 1876, the project providing for dredging a straight channel 100 feet wide to a navigable depth of 12 feet through Pine River to Round Lake, and protecting its sides by pile revetments and its entrance by crib piers 150 feet apart, extending to 12 feet of water in Lake Michigan. This project was extended to provide a revetted channel 12 feet deep from Round to Pine Lake. With this modification the estimated total cost was $186,000.

The amount expended to June 30, 1894, was $108,791.43. Expenditures during the past fiscal year were $1,734.20, and applied mainly to miscellaneous repairs of piers or dredging plant.

The approved project calls for a channel 12 feet deep, and this requires that the piers shall extend to at least that depth in Lake Michigan. The north pier fulfills that condition, but the south pier must be prolonged 200 feet to do so.

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July 1, 1894, balance unexpended		$3,708.57
Amount appropriated by act of August 17, 1894		8,000.00
		11,708.57
June 30, 1895, amount expended during fiscal year		1,734.20
July 1, 1895, balance unexpended		9,974.37
July 1, 1895, outstanding liabilities		278.60
July 1, 1895, balance available		9,695.77
Amount (estimated) required for completion of existing project		65,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix K K 15.)

16. Petoskey Harbor, Michigan.—Petoskey is so situated on the southeast shore of Little Traverse Bay that its water front is wholly exposed to winds coming from between west and northwest, and when high gales, with a sweep of more than 100 miles across Lake Michigan, blow from that quarter it is impossible, or at best highly hazardous, to make a landing in the immediate vicinity. The question of improving this condition of affairs has been under consideration since 1884, when, by the river and harbor act of July 5, Congress directed an examination "with a view to constructing a harbor of refuge" there. The conclusions arrived at from this and subsequent examinations, made under the provisions of the river and harbor act of August 11, 1888, were that a harbor of refuge for general commerce was not needed here, but that protecting works should be erected so as to provide a safe landing for the extensive local commerce that had developed and that is rapidly increasing. Work with this object in view has just been commenced pursuant to the river and harbor act of August 17, 1894, which contained the following provision:

Improving harbor at Petoskey, Michigan: Ten thousand dollars, to be expended together with the unexpended appropriations for this harbor, according to the larger of the two projects submitted in the report of December twenty-first, eighteen hundred and eighty-nine, and printed in the annual report for eighteen hundred and ninety, pages twenty-six hundred and seventy-four and twenty-six hundred and seventy-five.

The estimated total cost of the project named in the act was $170,000, and it is described in the report to which reference is made as "the construction of an outer and detached work, so designed as to shelter the landing, and possibly to furnish additional area within which vessels could take shelter on occasions."

Detailed plans for carrying out the approved project were duly prepared, and contract has been made for 700 linear feet of breakwater construction, to be completed during the present working season.

The total expenditure on account of this harbor to June 30, 1895, was $2,300.61.

July 1, 1894, balance unexpended		$34,776.78
Amount appropriated by act of August 17, 1894		10,000.00
		44,776.78
June 30, 1895, amount expended during fiscal year		2,077.59
July 1, 1895, balance unexpended		42,699.19
July 1, 1895, outstanding liabilities	$382.25	
July 1, 1895, amount covered by uncompleted contracts	39,882.10	
		40,264.35
July 1, 1895, balance available		2,434.84

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Amount (estimated) required for completion of existing project	$125,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix K K 16.)

17. Cheboygan Harbor, Michigan.—When survey was made at the mouth of the Cheboygan River in 1870 preparatory to commencing its improvement in the following year the navigable channel was only 6 feet deep. The original project of improvement was to dredge an entrance channel 200 feet wide, 14 feet deep, and protect its sides by pile piers and revetments, all at an estimated cost of $395,335. But as actually carried out the feature of side protection has been found unnecessary and therefore omitted; deducting $266,110, which was the proportional part of the total estimate applicable to the omitted feature, leaves $129,225 as the estimated cost of the improvement really undertaken. The dredging was carried to a depth of only 13 feet until 1880, when it was increased to 15 feet for a width of 50 feet in mid-channel. In 1882 it was decided to extend this depth over the full width of channel, and in 1888 to prolong the channel up to the State road bridge. In November, 1889, all the proposed dredging was completed, resulting in a 15-foot channel 200 feet wide, from deep water in the Straits of Mackinac to the State road bridge over the Cheboygan River, a distance of about 7,100 feet. A 40-foot square timber crib, constructed in 1881, marks the entrance to the channel and constitutes the foundation of a light-house subsequently erected by the United States Light-House Establishment.

The total expenditure for improving this harbor to June 30, 1895, was $132,488.29, of which $2,660.05 was expended during the last fiscal year.

Operations during the year were in pursuance of the following requirements of the river and harbor act of August 17, 1894:

"The Secretary of War is hereby directed to expend the unexpended balance on hand in dredging. He is also directed to make an estimate of the amount required to deepen the present channel to a depth of eighteen feet.

The required dredging was commenced May 16, 1895, and work was still in progress at the close of the year, the amount excavated up to that time being 36,086 cubic yards.

The estimated additional cost of completing the work of dredging to "deepen the channel to a depth of 18 feet" is $33,000.

July 1, 1894, balance unexpended		$18,171.76
June 30, 1895, amount expended during fiscal year		2,660.05
July 1, 1895, balance unexpended		15,511.71
July 1, 1895, outstanding liabilities	$3,904.14	
July 1, 1895, amount covered by uncompleted contracts	8,244.91	
		12,149.05
July 1, 1895, balance available		3,362.66

Amount that can be profitably expended in fiscal year ending June 30, 1897	15,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix K K 17.)

18. Alpena Harbor (Thunder Bay River), Michigan.—The city of Alpena occupies both banks of Thunder Bay River at its mouth, and this reach of river, about a mile long, together with the dredged channel through the bar in advance of it, constitutes Alpena Harbor, which has been the subject of improvements carried on by the Government

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since 1876, under appropriations for improving Thunder Bay Harbor and Thunder Bay River.

The original depth at entrance to the river was only 7 feet, but local enterprise increased it to 12 feet. The work of improvement by the Government has provided a wider channel and increased the depth to 13, 14, and 16 feet, under successive projects, whose costs were estimated at $4,764, $15,000, and $36,087, respectively; the total of the three separate estimates being $55,851. The proposed work was completed in 1893, and nothing has been done since then.

The total amount expended to June 30, 1895 was $41,139.49, of which $950.32 was spent during the last fiscal year.

The dredged channel has a total length of about 7,000 feet; its width is 200 feet at entrance of cut through the bar, 150 feet at a point of entrance between piers, and from that point, conforming to the distance between dock lines established, the width of 100 feet is held for a distance of 2,600 feet, beyond which it is 75 feet for a distance of 1,500 feet, and thence 50 feet to the head of navigation.

Soundings were taken in the improved channel June 22, 1895, extending from the entrance up to the first bridge over the river, the section above that point being so blockaded by rafts and logs in boom as to render its examination impossible. These soundings show that the 16-foot channel has shoaled to a navigable capacity of but little over 14 feet. Further shoaling is inevitable, and it is highly probable that a restoration of the channel will be demanded within the course of the next year. An appropriation of $2,500 will, with the unexpended balance now available, provide for this work.

July 1, 1894, balance unexpended	$4,810.83
Amount appropriated by act of August 17, 1894	4,000.00
	8,810.83
June 30, 1895, amount expended during fiscal year	950.32
July 1, 1895, balance unexpended	7,860.51
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	2,500.00

(See Appendix K K 18.)

19. Saginaw River, Michigan.—Before improvement the navigable capacity of this stream was limited by the bar at its mouth, where a channel depth of 8 feet only was available, and by several shoals between there and the city of Saginaw, over which still less depth was to be found. Its improvement was commenced in 1867 by dredging a straight cut through the bar at the mouth to a depth of 13 feet, the work being completed in the following years. In subsequent years the scope of operations was gradually extended to various shoals higher up, but subject to no general project until 1882, when a comprehensive and connected scheme of improvement covering the entire river was proposed and adopted. It called for a navigable channel 14 feet deep and 200 feet wide from Saginaw Bay to the upper limits of Bay City, about 8 miles above the point of beginning, and thence to the head of navigation, some 16 miles farther up, a channel of the same width but only 12 feet deep. The estimated cost of this project was $446,000, which, added to the estimated cost of the several preceding projects ($294,378), gives $740,378 as the estimate of cost for the whole improvement.

It should be observed that the above estimates concerned the question of original cost only, and took no note of cost of maintenance

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while the work of construction was in progress; but in a stream of this character that is a matter of great and constant expense, and in the absence of appropriations specifically applicable thereto its cost has of necessity been an annual tax of no small magnitude on the successive appropriations for construction. The sum total of appropriations that will have to be made before the work can be completed must therefore largely exceed the original estimates for construction only.

The total expenditure to June 30, 1894, was $654,973.98, and the result obtained was a through channel, with depths as proposed, from the bay to near the head of navigation. The channel had its full width of 200 feet in nearly all parts up to include the Bay City front, but above there the width obtained was generally from one-quarter to one-half of what it is proposed to make them.

The amount expended during the fiscal year was $3,649.13, applied to a resurvey of the river and to dredging. The latter work was commenced in the latter part May, 1895, and was still in progress at the close of the fiscal year, the amount dredged to that date being 36,226 cubic yards.

July 1, 1894, balance unexpended		$12,876.02
Amount appropriated by act of August 17, 1894		40,000.00
		52,876.02
June 30, 1895, amount expended during fiscal year		3,649.13
July 1, 1895, balance unexpended		49,226.89
July 1, 1895, outstanding liabilities	$10,319.80	
July 1, 1895, amount covered by uncompleted contracts	29,638.48	
		39,958.28
July 1, 1895, balance available		9,268.61
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		40,000.00

(See Appendix K K 19.)

20. Harbor of refuge at Sand Beach, Lake Huron, Michigan.—The site for this harbor was selected in 1872 after careful consideration. It is on the west shore of Lake Huron, 60 miles north of its outlet into the St. Clair River, and the artificial harbor built there since then is the only safe refuge on that coast from the foot of the lake to Tawas Bay, 115 miles above. The work of construction was commenced in 1873, under a project providing for three sections of breakwater, made of stone-filled crib work, so located as to shelter a water area of some 650 acres and for deepening this area by dredging where necessary. The estimated cost was $1,442,500. The sheltering breakwaters, with a total length of 8,132 feet, were completed in 1885 at a cost of about $975,000, and since that time expenditures have been applied to keeping them in repair, dredging, and supervising the berthing of vessels entering the harbor for refuge.

The total expenditure to June 30, 1894, was $1,133,078.53; for the fiscal year just closed, $51,296.10. The latter was applied to supervising the use of the harbor, minor repairs of breakwaters, and dredging.

The work of dredging was in progress at the beginning of the fiscal year and was continued until December 11; the amount excavated during that time was 85,832 cubic yards, the depth of dredging being to 21 feet.

The superstructure of the breakwaters contains many scattering timbers that show considerable decay, but as a whole it is yet in service-

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able condition, and may be kept so for a year or two yet with occasional repairs.

As respects the benefits to the general commerce on the Great Lakes, this harbor is second in importance to no other, but its local commercial interests are small. The number of vessels that took refuge at the harbor during the past fiscal year was 1,069, with a total tonnage of 445,544.63. The grand total of vessels entering for shelter during the calendar years 1877 to 1894, inclusive, is 21,525, the tonnage of which aggregated 6,929,527. The size of vessels sheltered in 1877 averaged 289 tons, and in 1894 this average had increased to 416 tons.

July 1, 1894, balance unexpended	$136,921.47
Amount appropriated by act of August 17, 1894	20,000.00
	156,921.47
June 30, 1895, amount expended during fiscal year	51,296.10
July 1, 1895, balance unexpended	105,625.37
July 1, 1895, outstanding liabilities	357.00
July 1, 1895, balance available	105,268.37

Amount that can be profitably expended in fiscal year ending June 30, 1897 20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix K K 20.)

21. Black River at Port Huron, Mich.—This stream flows through the city of Port Huron, Mich., and empties into the St. Clair River. Before improvement it had a navigable channel not less than 10 feet deep, except over a few shoals, where the depth was only 8½ feet, for a distance of about 2 miles from the mouth. The river and harbor act of September 19, 1890, appropriated $25,000 "to deepen channel from mouth to Grand Trunk Railway bridge to a depth of 16 feet," and a project for making such depth, with channel widths varying from 75 to 160 feet, according to locality, was thereupon prepared and approved. The estimated cost was $75,000. The appropriation was expended in 1891-92 in excavating within the limits indicated, resulting in a channel of the prescribed depth, with widths of 150 feet, 100 feet, and 50 feet, for distances of about 600 feet, 4,700 feet, and 3,000 feet, respectively. This was the condition of improvement June 30, 1894, at which date the total expenditures amounted to $34,698.65. No work was done during the last fiscal year, and expenditures were limited to $301.35 for contingencies, supervision, etc.

The dredged channel has become very much filled up since operations were suspended in 1893. An examination made July 1, 1895, showed a general depth of from 14½ to 15½ feet in the lower reach, where the depth was from 16 to 17 feet one year ago; and a short distance above the Seventh Street Bridge, a vessel drawing 12 feet was hard aground in the channel, where from 15 to 16 feet was the prevailing depth last year; from that point up but little evidence can be found of the dredged channel. The evidence is conclusive that the channel will have a fair degree of permanence where dredged to a width of 100 feet or more between docks, but that narrow channels dredged through the undocked sections above will rapidly fill up. The river and harbor act of August 17, 1894, appropriated $4,000 for "continuing improvement up to Washington avenue," and is, therefore, applicable only to the upper and undocked section of the river apparently. It is believed that the restoration and completion of the lower channels is a more important matter, and when this is done they should be dredged to a width of not less than 100 feet.

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July 1, 1894, balance unexpended	$301.35
Amount appropriated by act of August 17, 1894	4,000.00
	4,301.35
June 30, 1895, amount expended during fiscal year	301.35
July 1, 1895, balance unexpended	4,000.00
Amount (estimated) required for completion of existing project	36,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	4,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix K K 21.)

22. Mouth of Black River, Michigan.—An extensive shoal and a bar formerly existed in the St. Clair River, adjoining the mouth of the Black; the bar lay close to the American side and obstructed approach to the Port Huron docks, while the shoal, forming a "middle ground" nearly fifty acres in extent, crowded the main channel in a sharp curve close to the Canadian shore, thereby exposing the vast through commerce of the lakes to the dangers attendant upon passing a narrow and crooked channel with a current of high velocity. In 1871 a project was adopted for dredging the bar and middle ground to a uniform depth of 15 feet, by excavating 257,200 cubic yards, at an estimated cost of $120,660. The work was commenced in 1872 and completed in 1878. A slight shoaling took place in the years following, and the whole area was redredged between 1889 and 1892, the depth of excavation this time being 16 feet, except over a strip bordering the main channel, where it was increased to 18 feet.

The total expenditure to June 30, 1894, was $86,393.90. The amount expended during the past fiscal year was $492.04, and it was applied to redredging a narrow channel through the shoal adjoining the Port Huron dock line. The depth of water has been slowly decreasing since work was suspended in 1892; soundings taken July 1, 1895, show depths of from 15 to 16 feet where 17 or 18 existed a year ago, and an average depth of 17.4 feet as compared with last year's average of 18.3.

July 1, 1894, balance unexpended	$106.10
Amount appropriated by act of August 17, 1894	4,000.00
	4,106.10
June 30, 1895, amount expended during fiscal year	492.04
July 1, 1895, balance unexpended	3,614.06
Amount that can be profitably expended in fiscal year ending June 30, 1897	4,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix K K 22.)

23. Clinton River, Michigan.—This is a navigable stream emptying into Anchor Bay, as the northwesterly part of Lake St. Clair is called, with a natural channel depth of about 10 feet, except at shoals, over which but 5 or 6 feet could be carried before improvement, and a broad flat at the mouth with a general depth of from 3 to 4 feet. In 1870–71 a channel 9 feet deep, 60 feet wide, and 2,700 feet long was dredged through this flat, but being left without works of protection it soon filled in again. In 1880 a project of general improvement from the mouth to Mount Clemens, 8 miles upstream, was adopted, providing for a through channel 8 feet deep, protected by a pile dike at the mouth, extending across the flat to the curve of 10-foot depth in the bay, and by such revetments at points above as were deemed necessary. The estimated cost, as modified in 1885 and 1889, was $34,564.

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The total expenditure on the work from its commencement to June 30, 1894, was $52,752.80, of which $25,500 was applied to occasional and scattering work done prior to the adoption of the present approved project in 1885. The total expenditure applicable to the latter was $27,252.80.

As a result of these expenditures the proposed channel had been obtained by dredging, and kept in a fairly navigable condition by the aid of temporary revetments and occasional redredgings; but the appropriations were at no time sufficient to permit the construction of any protecting works of a permanent character, and the maintenance of the dredged channels, especially of that at the mouth, is wholly impossible, except at the expense of constant dredging, in the absence of such works.

No work was done during the past fiscal year, the expenditures for that period being $17.74 and applied to office expenses and supervision.

The river was examined July 5, 1895, and the channel depth at entrance found to be 7½ feet, with greater depths in the river above for most of its length; but there are several shoals with depths of from 6 to 6½ feet, and one with only 4½ feet. Funds now on hand will probably suffice to open proper channels through these worst places.

July 1, 1894, balance unexpended	$17.74
Amount appropriated by act of August 17, 1894	5,000.00
	5,017.74
June 30, 1895, amount expended during fiscal year	17.74
July 1, 1895, balance unexpended	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	2,500.00

(See Appendix K K 23.)

24. Rouge River, Michigan.—Before improvement this stream had a channel depth of from 10 to 17 feet from its mouth, near the southwestern limits of the city of Detroit, for a distance of about 3 miles, and was navigable for light drafts as far as Dearborn, about 15 miles from the mouth. The work of improvement was commenced in 1888, under a project for securing a channel depth of 16 feet, with a width of 240 feet, for a distance of 800 feet from the mouth, and thence with a width of 100 feet to the Wabash Railroad bridge, about 2⅔ miles farther up. The estimated cost was $31,690.39.

The work of improvement was completed in 1892, as projected, with a total expenditure of $30,272.79.

No work was done during the past fiscal year, during which time the expenditures amounted to $344, and were for office expenses, contingencies of supervision, etc.

The channel is slowly shoaling, but no complaints have yet been made concerning its navigable condition. An examination just made shows an available depth of from 13 to 15 feet over most of the length, but occasional soundings of from 11½ to 12½ feet are met with.

The commerce of the river is rapidly increasing with the establishment of large industries dependent upon a reliable water communication, and a demand for a restoration of the full channel depth is certain to come before long. Funds on hand will not suffice for this purpose, but it is suggested that the unexpended appropriation made by the river and harbor act of 1892 "for constructing a turning basin in Rouge River" might be made applicable thereto. If the turning basin should

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ever be really needed it could be made by increasing the width of dredging at the selected locality, but it is highly probable that the slips now being dredged by private parties from the river into the low grounds bordering it, and others that will be built in the same way, will permit vessels to be turned, and obviate the necessity of constructing a special basin for that purpose.

July 1, 1894, balance unexpended	$1,408.06
Amount appropriated by act of August 17, 1894	5,000.00
	6,408.06
June 30, 1895, amount expended during fiscal year	344.00
July 1, 1895, balance unexpended	6,064.06
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	5,000.00

(See Appendix K K 24.)

25. Turning basin in Rouge River, Michigan.—The river and harbor act of September 19, 1890, called for an estimate for "locating and constructing basin in said (Rouge) river, at a point on the same within 4 miles of its junction with the Detroit River, convenient for the turning and anchoring of vessels." Such estimate was submitted by Col. O. M. Poe, Corps of Engineers, in a report dated December 20, 1890, as follows: Three acres of land for site, at $1,500, $4,500; 74,074 cubic yards excavation, at 15 cents, $11,111.10; total, $15,611.10

The next river and harbor act, approved July 13, 1892, appropriated $5,000 for acquisition of land and beginning construction, according to the foregoing project. The appropriation has been found too small for purchasing the land needed, and accordingly no work has yet been done or expenditure made in relation to the proposed improvement.

It is now submitted that it is doubtful whether the construction of the proposed basin will be really necessary, for private parties have already constructed slips opening into the river (and others will undoubtedly follow) that will supply openings, opposite which vessels will in all probability be able to find turning room. If, however, the plan of constructing a turning basin is to be adhered to, work should not be commenced until all the money required to complete it has been appropriated; in this case an additional appropriation of $10,500 should be made. But it is suggested that the construction of the turning basin be abandoned, for the present at least, and that the money already appropriated be made available for general dredging in the Rouge River, as recommended in the report on its improvement.

July 1, 1894, balance unexpended	$5,000.00
July 1, 1895, balance unexpended	5,000.00

(See Appendix K K 25.)

26. Removing sunken vessels or craft obstructing or endangering navigation.—In the latter part of April, 1894, a wreck was discovered in Presqu 'Ile Harbor, Michigan, by which its channel was dangerously obstructed. The work of removing the wreck was commenced June 24 and completed July 15, 1894, at a total cost of $362.48.

Late in the fall of 1894 the steamer *D. M. Wilson* sunk in Lake Huron about 2 miles northeast of Thunder Bay Island Light Station. It lay in the track of general commerce, with its spars projecting above the water surface. No steps were taken toward removing it at the time because navigation was about to close. The ice and storms of winter and spring carried away the spars and upper works so that after the

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resumption of navigation in the spring all signs of the wreck had disappeared. The vicinity was carefully examined June 28, 1895, but the wreck was not found. It is believed to be no longer a source of danger to navigation, but arrangements have been made to have the vicinity carefully watched and the present position of the wreck found if possible.

(See Appendix K K 26.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations of the following localities, required by the act of August 17, 1894, were made by the local engineer, Lieut. Col. G. J. Lydecker, Corps of Engineers, and reports thereon submitted:

1. Preliminary examination of Kalamazoo River, Michigan, from its mouth to the city of Kalamazoo.—Lieutenant-Colonel Lydecker submitted report of examination December 31, 1894. He reports that the improvement of the mouth of the river by the General Government has been in progress since 1869, under appropriations for improving Saugatuck Harbor, with a view to securing a 12-foot navigable channel into Lake Michigan, but that the proposed channel has not yet been secured.

This section of the river, from Lake Michigan as far up as Saugatuck, a distance of about 3 miles, is reported as worthy of improvement to the extent contemplated by the project heretofore adopted, and the river above Saugatuck as not worthy of improvement by the General Government. The views of Colonel Lydecker are concurred in by this office.

A resurvey of the river up to Saugatuck is estimated to cost $350.

The report was transmitted to Congress and printed in House Ex. Doc. No. 199, Fifty-third Congress, third session. (See also Appendix K K 27.)

2. Preliminary examination of Kawkawlin River, Michigan.—Lieutenant-Colonel Lydecker submitted report of examination December 31, 1894. In his opinion, concurred in by this office, the locality is not worthy of improvement by the General Government at this time. The report was transmitted to Congress and printed in House Ex. Doc. No. 183, Fifty-third Congress, third session. (See also Appendix K K 28.)

3. Preliminary examination of Tittabawassee River, Michigan, from Saginaw to the head of navigation.—Lieutenant-Colonel Lydecker submitted report of examination December 31, 1894. It is his opinion, concurred in by this office, that this stream is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 185, Fifty-third Congress, third session. (See also Appendix K K 29.)

4. Preliminary examination of Shiawassee River, from Saginaw River to Bad River; Bad River to village of St. Charles; Flint River to head of navigation.—Lieutenant-Colonel Lydecker submitted report of examination December 31, 1894. He considers the Shiawassee and Bad rivers to be worthy of improvement by the General Government to such extent as will afford a reliable navigation for light-draft boats between Saginaw and the village of St. Charles, and estimates that it will cost $500 to make a survey necessary for preparation of plan of improvement with estimates; but he is of opinion that the Flint River is not worthy of improvement by the General Government. His views are concurred in by this office. The report was transmitted to Congress and printed in House Ex. Doc. No. 232, Fifty-third Congress, third session. (See also Appendix K K 30.)

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5. Preliminary examination of Clinton River, Michigan.—Lieutenant-Colonel Lydecker submitted report of examination December 31, 1894. He reports that this stream has been under improvement by the United States since 1870, and it is his opinion, concurred in by this office, that the improvement is worthy of completion by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 184, Fifty-third Congress, third session. (See also Appendix K K 31.)

Lieutenant-Colonel Lydecker was also charged with the duty of making surveys of—

1. Belle River, Michigan.

2. Sebewaing River, Michigan.

3. Pine River at St. Clair City, Mich.

Also, under provisions of joint resolution of Congress approved February 13, 1895, he was charged with the duty of making survey of—

Kalamazoo River from Lake Michigan to Saugatuck.

The reports of the results of these surveys will be duly submitted when received.

IMPROVEMENT OF WATERS CONNECTING THE GREAT LAKES.

This district was in the charge of Col. O. M. Poe, Corps of Engineers, having under his immediate orders Lieut. W. L. Sibert, Corps of Engineers, to August 13, 1894, Capt. Carl F. Palfrey, Corps of Engineers, from August 19, 1894, to January 21, 1895, and Lieut. Charles S. Riché, Corps of Engineers, the entire year.

1. Ship channel connecting waters of the Great Lakes between Chicago, Duluth, and Buffalo.—Before improvements were commenced under the project for this work the available depth for navigation in the connecting waters of the Great Lakes was about 16 feet.

The present project, submitted to Congress in pursuance of provisions of the act of September 19, 1890, and adopted by act of July 13, 1892, contemplates the excavation of a ship channel having a navigable depth of 20 feet in the shallows of the connecting waters of the Great Lakes between Chicago, Duluth, and Buffalo, at an estimated cost of $3,340,000.

The work is divided into eight sections, according to locality, and the following channels are to be or have been excavated:

Section 1. A channel 21 feet deep and 300 feet wide at Round Island Shoals, St. Marys River.

Section 2. A channel 21 feet deep and 300 feet wide in Little Mud Lake, St. Marys River, between the lower end of Sugar Island and the lower end of the "Dark Hole."

Section 3. A channel 21 feet deep and 300 feet wide through a reef in St. Marys River, abreast of Sailors Encampment Island.

Section 4. A channel 21 feet deep and 300 feet wide through a shoal in Mud Lake, St. Marys River, 1½ miles below Sailors Encampment Island.

Section 5. A channel 21 feet deep and 2,400 feet wide at the foot of Lake Huron.

Section 6. A channel 20 feet deep from deep water in St. Clair River through St. Clair Flats Canal to deep water in Lake St. Clair, with a width above St. Clair Flats Canal not greater than 650 feet; thence gradually narrowing to the canal; thence for the full width of the canal for its entire length; thence gradually widening to a width of 800 feet at deep water in Lake St. Clair.

Section 7. A channel 20 feet deep and 800 feet wide through Grosse-point Flats, Lake St. Clair, Michigan.

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Section 8. A channel 21 feet deep and 800 feet wide through the bar at the mouth of Detroit River.

To obtain a navigable depth of 20 feet, a depth of 21 feet is required where the excavation is through solid rock or through shoals infested with bowlders; a depth of 20 feet where the cut is through soft material.

Contracts for the excavations specified above were entered into December 31, 1892, and if no failure occurs in the appropriations the contract time for the completion of the specified channels is November 30, 1895. Work was begun under contract at the eight localities named during May and June, 1893.

On June 30, 1894, section 1 was completed, but work not cleaned up. Sections 2 and 3 offered no increased available depth. Section 4 was completed and contract closed. Section 5 was dredged to 21 feet over a width of 900 feet, but was not cleaned up. Section 6 was dredged to 20 feet over the full width of channel and was nearing completion. Sections 7 and 8 had no increased available depth.

On June 30, 1895, sections 1, 4, and 6 were completed and contracts closed. Section 2 is available for boats as rapidly as the work progresses, and the contract will probably be finished on time. Section 3 offers no advantages to navigation until completed. The work is likely to be dredged out on time with exception of final cleaning up. Section 5 is dredged to a width of 1,800 feet, but is not yet cleaned up. Section 7 will probably be completed this season. Section 8 offers a channel 400 feet wide, but the improvement will probably not be completed over its full width this season. Contract of November 9, 1894, for removing shoal in section 8 will be completed in a few days.

Specifications are prepared for removing shoal 3, section 1, between Big Point and the canal in St. Marys River, and for removing shoal 29, section 4, near Point aux Frênes in Mud Lake.

Total expended to June 30, 1894		$386,118.86
Expended during year ending June 30, 1895 (exclusive of outside liabilities)		802,077.99
Total expended to June 30, 1895		1,188,196.85
July 1, 1894, balance unexpended		863,881.14
February 19, 1895, repayment of overpayment made R. J. Cram, dredging section 1		2,778.06
Amount appropriated by sundry civil act approved March 2, 1895		500,000.00
		1,366,659.20
June 30, 1895, amount expended during fiscal year		802,077.99
July 1, 1895, balance unexpended		564,581.21
July 1, 1895, outstanding liabilities	$104,774.81	
July 1, 1895, amount covered by uncompleted contracts	293,383.54	
		398,158.35
July 1, 1895, balance available		166,422.86

Amount (estimated) required for completion of existing project..... 1,590,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897..... 500,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix L L 1.)

2. Operating and care of St. Marys Falls Canal, Michigan.—During the fiscal year the canal was open to navigation 226 days. It was closed

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for the winter December 5, 1894, and on April 25, 1895, was opened for the current season. Fifteen thousand two hundred and fifty-five vessels, etc., aggregating 13,947,613 registered tons and carrying 13,636,270 tons of freight and 28,309 passengers, passed through the lock in 6,452 lockages.

The staple articles transported were 2,860,770 tons coal, 9,075,775 barrels flour, 33,380,064 bushels wheat, 1,503,899 bushels grain (other than wheat), 76,318 tons manufactured and pig iron, 262,986 barrels salt, 105,931 tons copper, 6,927,246 tons iron ore, 732,911 M feet, B. M., of lumber, 40 tons silver ore, 23,857 tons building stone, and 457,547 tons unclassified freight.

The amount expended during the fiscal year ending June 30, 1895, was $50,908.67.

(See Appendix L L 2.)

3 St. Marys River at the Falls, Michigan.—The project for obtaining a navigable channel of 16 feet depth between Lakes Superior and Huron had been barely completed when the demands of commerce so enormously increased that the work of obtaining a depth of 20 feet throughout was undertaken with the full sanction of both legislative and executive authority.

A necessary part of the project was the construction of a new lock upon the site of the old State locks of a length of 800 feet between gates, a width of 100 feet throughout, a depth of 21 feet on the miter sills, and a single lift approximating 18 feet. The canal is to be deepened to correspond. The estimated cost of this enlargement of the canal system was $4,738,865, for the details of which see page 2220 et seq. of the Annual Report of the Chief of Engineers for 1887.

On June 30, 1894, the condition of the work was as follows:

The masonry of the 800-foot lock was completed except laying 128 stones and the gate anchorages and snubbing hooks were in position. The valves and valve frames were delivered. The lock floors, culverts, etc., were progressing at about the rate specified. The turbine power plant and the pumping plant for the 800-foot lock were under contract, but the condition of the power house was not sufficiently advanced to allow the shipment of this machinery. The lock gates were under contract, and one pair of small gates was practically ready for shipment and the two other small gates were about one-third as far along. The dam between the locks was completed, and the clay dam between the canal and river and the excavations and pier building within the cofferdam were under contract. The work of deepening the canal prism was well under way, and 72,076 cubic yards was removed from the first section, and 110,951 cubic yards was removed from the second. The drawings and specifications for the operating machinery and the power house and office building were completed.

The widening of the channel at the "Elbow," Lake George, St. Marys River, was completed.

On June 30, 1895, the work was in the following condition:

Excavation of lock pit practically completed, contract pending settlement. The masonry construction is practically completed. The floors, culverts, etc., are nearing completion; contract extended to July 15, 1895. The miter-sill valves are delivered and contract is closed. The turbine power plant is installed pending final working test. Pumping plant, the pumps, and Westinghouse engines are delivered and are being erected, and the boilers are stored at the makers' ready for delivery. The operating machinery is delivered and being erected. Excavation

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and building cribs within cofferdam, some filling, and about 2,000 cubic yards of excavation are still to be done. The clay dam is nearing completion. The lock gates are erected in place, except the foot bridges. Power house, the basement walls are about two-thirds done. Deepening canal prism, estimated, 280,000 cubic yards sandstone to be removed, of which 254,739 cubic yards (on both sections) is excavated. A contract was entered into for removing material from movable dam and lock approaches and building piers for lock approaches. Cement tests and water-level observations were continued during the year.

Total expenditure to June 30, 1894		$2,261,982.67
Expended during fiscal year (excluding outstanding liabilities)		610,090.75
Total expenditure to June 30, 1895		2,872,073.42
July 1, 1894, balance unexpended		1,718,043.96
Amount appropriated by sundry civil act approved August 18, 1894		300,000.00
Amount appropriated by sundry civil act approved March 2, 1895		483,865.00
May 22, 1895, repayment of disallowance of part of voucher 19, August, 1894		12.13
		2,501,921.09
June 30, 1895, amount expended during fiscal year		610,090.75
July 1, 1895, balance unexpended		1,891,830.34
July 1, 1895, outstanding liabilities	$110,304.81	
July 1, 1895, amount covered by uncompleted contracts	587,931.14	
		698,235.95
July 1, 1895, balance available		1,193,594.39

(See Appendix L L 3.)

4. Hay Lake Channel, St. Marys River, Michigan.—The channel was sufficiently advanced to allow the steamers *North West* and *J. H. Wade* to pass through on June 7, 1894, since which time vessels have been using the channel, which is 11 miles shorter than the Lake George Channel.

The contracts on the second and fifth sections were extended to September 1, 1894, and the contract on the sixth section to July 31, 1894.

On June 30, 1895, the entire channel had been dredged to a width of 300 feet and a depth of 20 and 21 feet, according to the specifications, and the entire commerce of St. Marys River, with exception of a few boats and rafts, is using this channel.

Contracts are in force for removing shoals at upper end of Hay Lake and cleaning up shoals near Nine Mile Point, the latter being nearly completed. The contract time for completing is December 1, 1895.

A shoal was discovered at the lower end of the fourth section with least depth of 17 feet. This shoal was undoubtedly formed by and during the progress of the work through Sugar Island Rapids, and specifications for its removal are in preparation.

The rapid increase of the number of vessels adds largely to the danger of accidents during night navigation of the Middle Neebish and makes the project of widening the channel through the rock at this locality to 400 feet one of great importance.

Also that portion of the channel between cross sections 504 and 754, a distance of 2,500 feet, which was improved to a depth of 20 feet, should be deepened to 21 feet, thus making it uniform with all the rest of the rockwork.

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Total expenditure to June 30, 1894		$1,669,940.44
Expended during fiscal year (exclusive of outstanding liabilities)		163,621.74
Total expenditure to June 30, 1895		1,833,562.18
July 1, 1894, balance unexpended		345,191.21
Amount appropriated by sundry civil act approved August 18, 1894		150,000.00
May 22, 1895, repayment of disallowance of part of voucher 8, August, 1894		10.82
		495,202.03
June 30, 1895, amount expended during fiscal year		163,621.74
July 1, 1895, balance unexpended		331,580.29
July 1, 1895, outstanding liabilities	$644.77	
July 1, 1895, amount covered by uncompleted contracts	25,416.30	
		26,061.07
July 1, 1895, balance available		305,519.22

(See Appendix L L 4.)

5. St. Clair Flats Canal, Michigan.—The project for the improvement of the canal contemplated driving a double row of sheet piling to a depth of 26 feet along the channel face of each dike, dredging the area between the dikes to a depth of 20 feet, continuing the channel above and below the canal to the same depth in river and lake, and rebuilding the decayed portions of the timber superstructure. It was considered sufficient to obtain a depth of 18 feet and to postpone obtaining a depth of 20 feet until the general project for a continuous depth of 20 feet along the entire water route had reached a more advanced stage. The estimated cost of obtaining these two depths was as follows:

For 18 feet	$365,000.00
For 20 feet	513,559.40

On June 30, 1893, the pile revetment along the channel face of each dike was completed and a channel 18 feet in depth extended from the 18-foot curve in St. Clair River, about 900 feet above the canal, for the full width of the canal (about 300 feet) and throughout the entire length; thence gradually widening to 380 feet at a distance of 300 feet below the canal; thence with a width of 380 feet a farther distance of 3,300 feet.

No work was done during the fiscal year, and the condition remains as stated in previous paragraph.

That portion of the general project calling for a depth of 20 feet in the canal and approaches was provided for in the river and harbor act of July 13, 1892, for "Ship channel connecting waters of the Great Lakes between Chicago, Duluth, and Buffalo," and has been completed. See section 6 of the 20 and 21 foot channel.

Total expenditure to June 30, 1895, is $760,223.46.

July 1, 1894, balance unexpended	$4,586.54
July 1, 1895, balance unexpended	4,586.54

(See Appendix L L 5.)

6. Operating and care of St. Clair Flats Canal, Michigan.—The canal is in the immediate charge of a custodian, who reports any violations of canal regulations, and also acts as inspector whenever work is in progress.

The damage done to the dikes by storms was repaired in previous years by placing cedar bark in the holes washed out. At those places along the dikes where the earth pressure is transmitted through the old work to the new pile revetment the latter was tied by means of iron rods passing through the dike to piles in rear of the dike.

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During the fiscal year ending June 30, 1895, the ordinary current expenses of operating and care of the canal, such as salary of custodian, trimming willows, etc., was $1,818.32.

(See Appendix L L 6.)

7. Detroit River, Michigan.—Originally the channel at Lime Kiln Crossing, Detroit River, could not be depended upon for more than 13 feet of water, the ordinary depth being much affected by the direction of the wind. As originally projected in 1874, the improvement at this point was to consist of a curved channel 300 feet wide with a uniform depth of 20 feet, and the original estimate was based upon this project.

In 1883 it was wisely determined to so modify the project as to secure a straight channel, the least width of which should be 300 feet, with a somewhat greater width at each end, utilizing the work already done.

In 1886 this was further modified to the end that the width of the channel should be increased to 400 feet by removing an additional 100 feet from the western (American) side, and in 1888 a further additional width of 40 feet on the western side was authorized, as the lowest bid under the final appropriation was so low that the money available was sufficient to pay for the increased excavation.

The 440-foot channel was completed during the fiscal year ending June 30, 1891, at a cost of but little more than half the estimate for the 400-foot channel.

The present project for improving Detroit River contemplates the removal of such shoals between Detroit, Mich., and Lake Erie as obstruct navigation.

The obstructions found by sweeping in 1893 are a menace to navigation, and since nearly 25,000,000 tons of freight pass through this river each year these obstructions should be removed, cost what it may.

The ship channel connecting waters of the Great Lakes between Chicago, Duluth, and Buffalo can not be available for vessels drawing more than 16½ feet of water until these obstructions in Detroit River are removed.

The estimate for obtaining a channel 20 feet deep and 800 feet wide from the head of Ballards Reef to the head of Lime Kiln Crossing is $180,000, of which $58,742.66 has been made available, leaving $121,257.34 to be appropriated.

Under contract of October 20, 1894, 2,230.5 cubic yards of bowlders has been removed during the fiscal year, making a channel 18 feet deep, over a length of 3,200 feet from the head of Ballards Reef, and 300 feet wide west of the channel line. The upper 800 feet of this area has been dredged to a depth of 20 feet.

Total expenditure to June 30, 1894		$704,367.75
Expended during fiscal year		1,583.63
Total expenditure to June 30, 1895		705,951.38
July 1, 1894, balance unexpended		28,742.66
Amount appropriated by act of August 17, 1894		30,000.00
		58,742.66
June 30, 1895, amount expended during fiscal year		1,583.63
July 1, 1895, balance unexpended		57,159.03
July 1, 1895, outstanding liabilities	$1,053.12	
July 1, 1895, amount covered by uncompleted contracts	56,105.91	
		57,159.03
Amount (estimated) required for completion of existing project		121,257.34
Amount that can be profitably expended in fiscal year ending June 30, 1897		30,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix L L 7.)

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IMPROVEMENT OF RIVERS AND HARBORS ON LAKE ERIE, WEST OF ERIE, PENNSYLVANIA.

This district was in the charge of Lieut. Col. Jared A. Smith, Corps of Engineers.

1. Monroe Harbor, Michigan.—This harbor is in the Raisin River, about 2½ miles above the mouth of the dredged canal which forms the present outlet into the lake. The mouth is protected by two piers, the one on the north side being of crib work filled with stone and the one on the south side being a construction of piling, and crib work.

The canal is 4,000 feet long, 100 feet wide, and was dredged to a depth of 10 feet. The sides of the canal are protected by sheet piling, supported by ordinary piles and waling pieces. This improvement was commenced in 1835, and was completed many years ago. Before the improvement was commenced the mouth of the river was at a point about 2 miles south of present piers, and the channel was over a very shallow bar. At present the depth of water exceeds 9 feet over the bar and thoroughout most of the channel to the wharves.

A project for repairs to piers and canal revetment was adopted in 1886, the cost then being estimated at $20,000. In 1891 the estimate was increased to $26,000.

The amount expended upon the improvement previous to the project for repairs in 1886, was	$213,515.27
Expended under project for repairs to June 30, 1894	21,915.00
Expended and incurred in last fiscal year	1,113.18

Previous to June 30, 1894, the superstructure of north pier, 1,122 feet long, had been entirely rebuilt and the outer end of south pier had been repaired. The superstructure of south pier is now being rebuilt as far as available funds will permit.

The canal revetment is in bad condition, and as it is needed to protect the channel it should be repaired. The depth of water in the channel over the bar and in the river is about 9 feet, which is sufficient for the necessities of the very small commerce of Monroe.

July 1, 1894, balance unexpended	$100.00
Amount appropriated by act of August 17, 1894	5,000.00
	5,100.00
June 30, 1895, amount expended during fiscal year	485.06
July 1, 1895, balance unexpended	4,614.94
July 1, 1895, outstanding liabilities	628.12
July 1, 1895, balance available	3,986.82
Amount (estimated) required for completion of existing project	11,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix M M 1.)

2. Toledo Harbor, Ohio.—The original project for improving this harbor was adopted in 1866, pursuant to the act of June 23, 1866, appropriating $20,000 for the improvement. The project provided for improving the old channel through Maumee Bay by dredging to a depth of 12 feet and width of 200 feet. This was amended from time to time until the old channel had a least depth of 15.5 feet.

In 1887 a project was adopted, in compliance with requirements of previous acts of Congress, for a straight channel through Maumee Bay. The line was so located as to utilize the old channel as far as possible,

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and was planned for a width of 200 feet and a depth of 17 feet. Owing to the great length the width is insufficient, and the outer section will be widened to 300 feet as soon as practicable. The entire length of straight channel is about 8 miles. It is situated almost on the middle line of Maumee Bay from the mouth of the river to deep water in the lake.

Amount expended upon old channels, 1866 to 1893	$724,332.61
Amount expended upon straight channel and extending improvement up the river to June 30, 1894	583,763.26

This had resulted in entirely dredging the straight channel 200 feet wide and 17 feet deep as planned, and most of the channel had been still further dredged to remove deposits and give greater depth. A dredge plant had been purchased, and used in removing shoal in the river.

July 1, 1894, a contract was outstanding for dredging in straight channel; work was continued until November 24, 1894, when the contract was completed.

In March, 1895, a contract for further dredging in straight channel was made; work was commenced May 6 and was in progress June 30, 1895.

Soundings taken in May, 1895, show a good channel, with depths greater than 17 feet throughout in middle of channel, and depths ranging from 16 to 20 feet on the sides of channel.

The improvement has been extended up the Maumee River as indicated in river and harbor acts of July 13, 1892, and August 17, 1894. A channel 400 feet wide, 4,000 feet long, and 18 feet deep has been nearly completed over the bar at "The Crossing," and a second channel of about equal dimensions has been about one-fourth completed over the bar above Cherry Street Bridge. These shoals have been removed by the dredge belonging to the United States.

Vessels drawing 17 feet have no difficulty in entering Toledo Harbor when the lake is not lower than mean level. The channel in the bay should be made at least 100 feet wider throughout. It is proposed to expend the next appropriation in widening the channel and maintaining the depths already dredged.

July 1, 1894, balance unexpended		$96,485.10
Amount appropriated by act of August 17, 1894		70,000.00
		166,485.10
June 30, 1895, amount expended during fiscal year		89,498.12
July 1, 1895, balance unexpended		76,986.98
July 1, 1895, outstanding liabilities	$10,088.59	
July 1, 1895, amount covered by uncompleted contracts	32,005.14	
		42,093.73
July 1, 1895, balance available		34,893.25

Amount (estimated) required for completion of existing project	1,130,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	150,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix M M 2.)

3. Port Clinton Harbor, Ohio.—An examination of the harbor and a plan of improvement was made in 1870. The channel then was narrow and crooked, with a depth not exceeding 5 feet.

Under the appropriation of July 10, 1872, the improvement was commenced by dredging a channel through the bar at the mouth.

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In 1875 a plan was adopted to confine the channel over the bar by piers. It consists of a pile revetment 967 feet long, running from the north shore of Portage River out into the lake in a direction north 57° east, and then in a more northerly direction 301 feet farther, to where a pile dike is commenced, and was planned to be extended 1,200 feet to where the ordinary lake depth is but 12 feet.

The east pier was designed to be a simple pile structure about 2,600 feet long, the outer portion being parallel to and 200 feet distant from the west pier, and the inner end reaching the shore of the lake, which at that point is also the south shore of the river at its mouth.

The last estimate of cost was	$90,000.00
The expenditure from 1872 to June 30, 1894, was	75,315.53

As a result the piers had been extended as far as has been considered necessary, the east pier being 2,180 feet long in 1882, and the west pier being 1,948 feet long in 1883. The later work has been mainly in dredging.

There is now a good channel depth exceeding 10 feet over a width of 100 feet between piers, and 200 feet opposite the wharves.

Under special act of Congress the point of land from which the west pier starts was purchased by the United States in 1894.

The channel is ample for all present necessities of the place. The piers are, however, in an advanced stage of decay and should be repaired.

The funds now available will be used in repairs of piers.

July 1, 1894, balance unexpended	$2,396.16
Amount appropriated by act of August 17, 1894	6,000.00
	8,396.16
June 30, 1895, amount expended during fiscal year	1,961.88
July 1, 1895, balance unexpended	6,434.28
July 1, 1895, outstanding liabilities	42.20
July 1, 1895, balance available	6,392.08
Amount (estimated) required for completion of existing project	21,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	6,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix M M 3.)

4. Sandusky Harbor, Ohio.—A survey of this harbor was first made in 1826 to ascertain what improvements were needed. The first improvement was made under the appropriation of $15,000 by act of June 11, 1844. The depth of water over the bar was then but 10 feet and the greatest depth of water in the bay was 12 feet.

Various improvements to the harbor and approaches were made from 1844 to 1888 when the project for a straight channel from Cedar Point to the east end of dock channel was adopted. The channel was then about 15 feet deep, but was indirect and narrow in most places.

Expenditures for improvements previous to adoption of project for straight channel	$280,080.00
Amount expended on straight channel to June 30, 1894	99,050.71

The straight channel, 200 feet wide and 17 feet deep, was then nearly completed. The dock channel had filled so as to have but 13 to 14 feet depth, and the channel over the bar was narrow and irregular with a depth of 16 feet.

The straight channel was completed August 31, 1894, its entire expense being $112,984.83.

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The river and harbor act of August 17, 1894, appropriated $30,000 for continuing the improvement and required a plan and estimate of further necessary improvements.

A report on this subject was submitted to Congress and published in House Ex. Doc. No. 91, Fifty-third Congress, third session. It is also submitted herewith in Appendix M M 4.

The officer in charge of the work estimates the cost of necessary improvement to be $255,000, or $225,000 after expenditure of funds made available by last appropriation.

Since completion of straight channel, dredging has been continued on the bar and in dock channel, resulting in very great benefit to the commerce of the place. The channel over bar now exceeds 17 feet in depth and is well buoyed. The dock channel has been made 17 feet deep over a width of 89 feet, and more than one-half the entire length. Dredging will be continued as long as available funds will permit.

July 1, 1894, balance unexpended	$20,391.81
Amount appropriated by act of August 17, 1894	30,000.00
Deposited by L. C. Overman	25.00
	50,416.81
June 30, 1895, amount expended during fiscal year	32,125.84
July 1, 1895, balance unexpended	18,290.97
July 1, 1895, outstanding liabilities	1,821.69
July 1, 1895, balance available	16,469.28
Amount (estimated) required for completion of existing project	225,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	40,000.00

(See Appendix M M 4.)

5. Sandusky River, Ohio.—In 1880 a project was adopted for opening a channel 100 feet wide and 9 feet deep through the bars between the city of Fremont and the channel in Sandusky Bay. The expense was estimated to be $44,000.

Amount expended and incurred on the work to June 30, 1894, was	$27,449.93
Expended in last fiscal year	550.70
Total	28,000.00

The expenditures have been for dredging bars in the river, the latest being in 1893 for dredging channel through bar at mouth of the river. There was then a channel of 10 feet depth over the bar and nearly 9 feet in most of the river above. The shallowest part of channel in Sandusky Bay is but 8½ feet, and at present there is no greater depth than 8½ feet over the bar dredged 10 feet two years ago.

The balance of original estimate, after deducting appropriations, is $16,000, which is now insufficient to complete the channel originally planned owing to the fact that the estimate was made fifteen years ago, during which time there have been five appropriations, aggregating less than two-thirds of the amount of the estimate.

The commerce of the river is very small and entirely local; the benefits to navigation and commerce are therefore equally so.

July 1, 1894, balance unexpended	$550.07
June 30, 1895, amount expended during fiscal year	550.07
Amount (estimated) required for completion of existing project	16,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

(See Appendix M M 5.)

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6. Huron Harbor, Ohio.—In 1826 the mouth of the river was closed by a sand bar. Improvements, consisting of parallel piers to confine and protect the channel, were then undertaken.

The total amount appropriated and expended from 1826 to June 30, 1890, was $123,273.71.

As a result, the channel had been secured through a sand bar, which was sometimes dry, and given a depth of water which was generally as great as 16 feet between piers about 140 feet apart.

The latest project in 1890, in compliance with requirements of the river and harbor act of September 19, 1890, consists in extending the piers to the contour of 16-foot depth in the lake, with a view of obtaining that depth at the entrance and between the piers.

The original estimate of cost of piers, as revised in 1893, is	$145,000.00
Expended previous to June 30, 1894, in extending piers	20,000.00
Expended to June 30, 1894, in renewing and repairing superstructure of old work and in dredging	9,856.55

The east pier had been extended 80 feet and the west pier 160 feet. Two parts of superstructure of west pier, a total of 288 linear feet, had been entirely removed and rebuilt; minor repairs to both piers had been made and the channel dredged to 16 feet depth.

In July, 1894, the channel at entrance was dredged to a depth of 18 feet.

A contract has been let for extending east pier 72 linear feet. This work is now in progress, and will be completed not later than August, 1895.

July 1, 1894, balance unexpended		$1,160.12
Amount appropriated by act of August 17, 1894		10,000.00
		11,160.12
June 30, 1895, amount expended during fiscal year		1,071.44
July 1, 1895, balance unexpended		10,088.68
July 1, 1895, outstanding liabilities	$98.67	
July 1, 1895, amount covered by uncompleted contracts	6,390.86	
		6,489.53
July 1, 1895, balance available		3,599.15

Amount (estimated) required for completion of existing project	117,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix M M 6.)

7. Vermillion Harbor, Ohio.—In 1836 there was less than 2 feet of water over the bar at the mouth of the river, and a project was adopted to extend parallel piers 125 feet apart over the bar into the lake. This was amended from time to time until the piers were extended to a depth of 12 feet in the lake in the spring of 1874. The east pier was then 1,075 feet and the west pier 1,125 feet in length. In the same year a project was adopted to remove rock and other material between the piers and into the lake to afford a depth of 14 feet over a width of 100 feet. This was completed in 1879.

Since that time the channel has varied, but is rarely less than 12 feet. The piers have been repaired from time to time.

The amount expended for construction and repairs from 1836 to completion of the work in 1879 was	$113,701.28
Since that date there have been seven appropriations expended for repairs, of an aggregate amount of	15,000.00
Expended in last fiscal year	2.45

No works of improvement or repair have been carried on in the last fiscal year.

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The appropriation of $2,000 by act of August 17, 1894, is required for repairs to the piers, and will be expended for that purpose during the ensuing year.

No further improvements at this place are recommended, but it is considered desirable to maintain the piers by keeping them in repair.

Amount appropriated by act of August 17, 1894	$2,000.00
June 30, 1895, amount expended during fiscal year	2.45
July 1, 1895, balance unexpended	1,997.55
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	4,000.00

(See Appendix M M 7.)

8. Black River Harbor, Ohio.—Improvements upon this harbor were commenced in 1828 by extending parallel piers or jetties across the bar to protect and confine the channel. Various amendments and additions to the plan have been made from time to time. In 1891 the extension of piers to 17 feet depth in the lake was recommended by the officer in charge of this improvement.

The entire amount appropriated and expended in improving this harbor from 1828 to 1892 was $232,204.77. As a result the piers had been extended to a depth of about 16 feet in the lake, and the channel ordinarily had a clear depth of 16 feet or more in the middle between piers. It was, however, subject to fluctuations and to the formation of bars outside, so that dredging is needed nearly every year.

As the river and harbor act of July 13, 1892, appropriated an amount in excess of the estimate to extend piers to a depth of 16 feet, the recommendation of the officer in charge of the improvement to extend them to a depth of 17 feet was approved in 1893. The estimated cost was $56,000.

Expenditures, including liabilities, to June 30, 1894, $19,799.74.

This included an entire rebuilding of 151.5 feet of east pier, extensive repairs to west pier, and an extension of 40 feet to each pier.

In July, 1894, repairs were made to piers, and in May, 1895, the channel was dredged over a length of 1,500 feet and width of 75 feet to a depth exceeding 18 feet.

A contract has been let for extending west pier 72 feet. At the end of the fiscal year this work was in progress and it will be completed in August.

A new manufactory for steel has been established at Lorain and will do much to increase the commerce and consequent necessities for a good harbor.

July 1, 1894, balance unexpended		$226.93
Amount appropriated by act of August 17, 1894		10,000.00
		10,226.93
June 30, 1895, amount expended during fiscal year		2,797.61
July 1, 1895, balance unexpended		7,429.32
July 1, 1895, outstanding liabilities	$19.50	
July 1, 1895, amount covered by uncompleted contracts	6,390.86	
		6,410.36
July 1, 1895, balance available		1,018.96
Amount (estimated) required for completion of existing project		38,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix M M 8.)

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9. Cleveland Harbor, Ohio.—In 1825 the mouth of the Cuyahoga River was obstructed by a long sand bar and the depth of water was but about 3 feet.

A plan of improvement was adopted to straighten the channel at the mouth of the river by constructing parallel piers to confine the current and direct the channel over the bar. The plan was modified and extended from time to time until the piers had reached a depth of 16 feet in the lake, and the channel between them had attained a depth of 15 to 16 feet. This project was completed in 1869.

Subsequent appropriations to 1874 were expended in dredging the channel, and in repairing and rebuilding parts of the piers.

The total expenditure on this improvement previous to 1875 was $346,881.61.

In 1875, in compliance with an act of Congress, a project was adopted for constructing a harbor of refuge, as the river afforded no anchorage. The project now includes two breakwaters, one west and one east of the channel entrance, the opening between being 500 feet wide. The west breakwater was completed in 1883. The length of the shore arm is 3,130 feet, and the part parallel to the shore is 4,030 feet long, a total of 7,160 feet, besides a spur 100 feet long projecting into the lake near the east end. Previous to June 30, 1893, the east breakwater had been extended a distance of 2,043 linear feet, besides a spur 118 feet long projecting into the lake near its west end.

Since adoption of this project in 1875 to June 30, 1894, the total expenditures have been $1,285,818.91, of which a total of about $70,000 has been expended in maintenance of depths in channel and anchorage and of old piers.

The river piers and parts of breakwater first built are becoming so much deteriorated by decay and various causes that the rebuilding of them at an early day is imperatively needed. This is especially true of the breakwater, which may otherwise suffer great loss by destruction.

The estimate for completion of project covers only the first construction of breakwater and makes no provision for maintenance of breakwater, piers, or channels. It will be necessary to include an estimate at an early day to cover expense of complete and permanent repairs.

The anchorage of the harbor is ample in extent for all present or probable future necessities, but there are indications that business will soon develop on the lake front, when the entire harbor room as planned will be needed.

Upon petition of the Chamber of Commerce of Cleveland, an opening of 200 feet in shore arm of west breakwater has been authorized by the Secretary of War. The work of removing the part of the breakwater to form the opening is about one-half completed.

Extensive repairs are annually required upon the old parts of breakwater and piles, and dredging is annually required to maintain the channel depths. In October and November, 1894, the usual autumn repairs were made to the breakwater to close all small breaks and reduce the danger of extended injury in the winter storms.

The amount which will remain from the last appropriation of $50,000 is insufficient for a satisfactory expenditure upon any part of the improvement either in extension or repairs.

The officer in charge of the work has recommended that the pier on east side of the river be rebuilt in a permanent manner as far as funds will permit, and the recommendation has been approved. The entire appropriation will be expended before the close of the next fiscal year.

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July 1, 1894, balance unexpended	$186.90
Amount appropriated by act of August 17, 1894	50,000.00
Collection by United States attorney	50.00
	50,236.90
June 30, 1895, amount expended during fiscal year	3,621.97
July 1, 1895, balance unexpended	46,614.93
July 1, 1895, outstanding liabilities	1,220.28
July 1, 1895, balance available	45,394.65

Amount (estimated) required for completion of existing project	494,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix M M 9.)

10. Fairport Harbor, Ohio.—The harbor of Fairport is near the mouth of the Grand River, Ohio, which is navigable for some distance from the lake.

In 1825 the sand bar across the mouth was so hard and dry in the summer that teams could be driven across. In that year a plan was adopted for improving the harbor by the method of parallel piers to confine and protect the channel. The plans have been modified and extended from time to time until 1890, when the latest project was adopted, providing for extending the parallel piers to a depth of 18 feet in the lake.

The estimated cost, revised in October, 1892, included extending each of the piers 1,060 feet (2,120 linear feet), at $100 per foot, $212,000.

The entire amount expended from 1825 to adoption of present project in 1892 was	$319,503.08
Amount expended for construction and maintenance, July 1, 1892, to June 30, 1894	29,553.90
Expended and incurred in last fiscal year	13,830.45

At the time the last project was adopted the depth between piers was 16 feet and over the bar 15½ feet. The piers outside the shore line were in need of repairs and inside the shore line both piers were in bad condition. The east pier has been extended 120 feet and the west pier 160 feet.

In the last fiscal year the bar has been twice dredged to a depth of 18 feet.

A part of the west pier, about 138 feet long, was found in such bad condition that its entire renewal was necessary. This work was done in a substantial manner by contract in the spring of 1895. The new part of pier is 20 feet wide; it rests upon the bottom dredged to a depth of 20 feet, and the superstructure is 6 feet above water.

Owing to the condition of the piers and the uncertainty of the channel depth over the bars, it is not deemed prudent to expend the entire balance of appropriation in extending piers. If a part only be used for that purpose it will do but little good and the cost will be proportionately large. The balance will therefore be reserved for such repairs and maintenance as may be required until another appropriation is made available.

A special report with reference to the use of the east pier by a transportation company, to a claim made for amount forfeited by failure to fulfill a contract for dredging, and to the establishment of harbor lines is included in the report of the officer in charge of the improvement.

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July 1, 1894, balance unexpended	$6,816.52
Amount appropriated by act of August 17, 1894	20,000.00
	26,816.52
June 30, 1895, amount expended during fiscal year	13,784.62
July 1, 1895, balance unexpended	13,031.90
July 1, 1895, outstanding liabilities	45.83
July 1, 1895, balance available	12,986.07
Amount (estimated) required for completion of existing project	190,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix M M 10.)

11. Ashtabula Harbor, Ohio.—In 1826 the natural conditions at the mouth of the Ashtabula River gave but 2 feet depth of water over the bar and the rock bottom was but 9 feet below the lake surface.

Improvements were then commenced by confining the channel between piers of timber cribs filled with stone. The work has since been repaired, extended, and modified as necessities demanded.

In 1890 and 1891 a plan was adopted to widen the entrance by moving the east pier 45 feet eastward, and to give a greater depth by extending both piers to the depth of 22 feet in the lake and removing the stone and other material to a depth of 20 feet.

Total expenditures, 1826 to 1892, previous to project for greater width and a depth of 20 feet	$458,734.46
Incurred on present project to June 30, 1894	72,390.30

Expenditures of the last year have been mainly for renewal of superstructure of part of west pier over a length of 633 feet.

A very complete survey was made of the harbor and vicinity in October, 1894, in conformity with requirement of the river and harbor act of August, 17, 1894. The officer in charge of the improvement, in his report of February 28, 1895, herewith, recommends the construction of two breakwaters at a cost of $465,000. If this be done the extending of piers according to present project will not be needed and the cost of that part of the improvement will be reduced by $114,000.

In February, 1895, a hydrographic survey was made through the ice to determine amount of rock to be removed to obtain a depth of 20 feet.

A contract was let in March, 1895, for removing the rock to a depth of 20 feet. The price, 97 cents per cubic yard, in place, is exceptionally low, so that the entire amount can be removed with available funds and leave a balance for other work.

Ashtabula Harbor has the largest freight tonnage of ore and coal of any harbor on Lake Erie, and its importance to the lake marine is proportionately great.

July 1, 1894, balance unexpended	$6,836.95
Amount appropriated by act of August 17, 1894	75,000.00
	81,836.95
June 30, 1895, amount expended during fiscal year	7,777.49
July 1, 1895, balance unexpended	74,059.46
July 1, 1895, outstanding liabilities	125.
July 1, 1895, balance available	73,934.46
Amount (estimated) required for completion of existing project	180,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix M M 11.)

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12. Conneaut Harbor, Ohio.—The improvement of Conneaut Creek was commenced in 1829 by constructing piers to deepen the water over the bar at the mouth. Appropriations for continuing the improvement were made at irregular intervals until 1875.

The total amount appropriated and expended for construction and maintenance, 1829 to 1875, was $106,629.39.

The channel originally had a depth of only 2 feet. The result of the improvements was a depth of 8 to 9 feet ordinarily, with a maximum depth of 11 feet under favorable conditions.

The works were subsequently allowed to go to decay, owing to the decline of commerce at that place. In 1890 a vessel drawing more than 3 feet could not get over the bar.

The river and harbor act dated July 13, 1892, appropriated $40,000 under certain conditions for the improvement, which conditions were modified by an act approved February 24, 1893. These points were explained in Annual Report of Chief of Engineers for 1893.

Amount expended upon this project to June 30, 1894	$39,979.06
Amount expended in last fiscal year, including liabilities	18,392.03

At the end of the last fiscal year complete surveys had been made, the character of the bottom had been ascertained by boring and dredging, the old west pier had been repaired, and 400 linear feet of new pier 24 feet wide had been completed.

In September, 1894, the old west pier was again repaired, and its exposed head was protected by a triangular crib filled with stone.

The recommendation of the officer in charge of the work to expend the appropriation of August 17, 1894, in constructing a new pier on east side of channel at the mouth of the river, and to make the needed repairs of old work by hired labor, was approved.

Contracts were made with lowest bidders, after advertising, for timber, iron, and stone. The work of construction was commenced April 8, 1895, and at the end of the fiscal year 3 cribs, each 100 feet in length, were ready to sink. Work on this pier will be continued as far as may be permitted by available funds, which will be expended before close of the working season.

The development of commerce at this harbor has been very rapid and the works planned are now very much needed to protect the numerous vessels, among which are steamers of a new line to carry loaded cars across the lake.

July 1, 1894, balance unexpended		$20.94
Amount appropriated by act of August 17, 1894		40,000.00
		40,020.94
June 30, 1895, amount expended during fiscal year		16,852.59
July 1, 1895, balance unexpended		23,168.35
July 1, 1895, outstanding liabilities	$1,539.44	
July 1, 1895, amount covered by uncompleted contracts	6,105.00	
		7,644.44
July 1, 1895, balance available		15,523.91

Amount (estimated) required for completion of existing project	420,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	40,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix M M 12.)

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SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The river and harbor act of August 17, 1894, contains an appropriation of $75,000 for improving harbor at Ashtabula, Ohio, including a survey to determine what improvement thereof should be made with a view to making it a harbor of refuge and enlarging its capacity for the purposes of commerce. The survey thus provided for has been made, and the report of results was submitted by Lieut. Col. Jared A. Smith February 28, 1895. It is stated that there is no anchorage ground within the limits of the survey except where too shoal for use. Lieutenant-Colonel Smith suggests, instead of extending the piers at Ashtabula, as proposed in the existing project, the construction of two breakwaters, each 1,500 feet long, to facilitate the entrance of vessels and increase the harbor for refuge and commerce, at an estimated cost of $465,000. (See Appendix M M 13.)

IMPROVEMENT OF ERIE HARBOR, PENNSYLVANIA, AND OF RIVERS AND HARBORS IN WESTERN NEW YORK.

This district was in the charge of Maj. E. H. Ruffner, Corps of Engineers; Division Engineer, Col. Henry L. Abbot, Corps of Engineers.

1. Erie Harbor, Pennsylvania.—The original survey of this harbor was made in 1819, at which time the channel was narrow and tortuous, with a depth of only 6 feet. In 1823 a plan for the improvement was adopted, and constitutes the present work, excepting some necessary changes. The piers have been extended from time to time, and are now in fairly good condition, excepting the north pier, which needs repairs to the older portions.

The present project contemplated the extension of the piers to the 16-foot curve in the lake and the maintenance of a channel of navigable width 16 feet in depth from the harbor inside to the lake outside. Such a channel, 275 feet wide and not less than 18 feet deep, has been secured, and is now successfully maintained throughout its entire length of 7,150 feet.

The work during the year consisted in dredging a shoal place in the channel. Small repairs to existing structures were made.

The total amount expended up to June 30, 1894, was $831,219.27. The total amount expended during the fiscal year ending June 30, 1895, was $3,675.04.

July 1, 1894, balance unexpended (includes $20,000 reserved for Presque Isle)	$45,364.85
Amount appropriated by act of August 17, 1894	10,000.00
	55,364.85
June 30, 1895, amount expended during fiscal year	3,675.04
July 1, 1895, balance unexpended	51,689.81
July 1, 1895, outstanding liabilities	80.00
July 1, 1895, balance available	51,609.81

(See Appendix N N 1.)

2. Presque Isle Peninsula, Erie Harbor, Pennsylvania.—In a report upon the examination of Erie Harbor, made in 1885, it was recommended that the neck of the peninsula be protected by a breakwater, and the movement of sand around the eastern end of the peninsula, which threatens to close the harbor entrance, be arrested by the construction of jetties perpendicular to the shore of the peninsula, at an estimated cost of $173,044.50.

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Work under this project was in progress until October, 1889, when it was abandoned, it having been found that the structures built would not stand against the violence of the storms. No further work is at present contemplated, but the sum of $20,000 has been reserved from the appropriation for the improvement of Erie Harbor, to be used, in case of necessity, in closing any breach which may occur.

The total amount expended up to June 30, 1890, was $60,000. Nothing was expended during the fiscal year ending June 30, 1895.

(See Appendix N N 2.)

3. Dunkirk Harbor, New York.—The improvement of this harbor was begun in 1827, when the first appropriation therefor was made. The original project was much the same as that of the existing improvement, which comprises the formation of an artificial harbor in front of the city by means of a breakwater running nearly parallel with the shore and a shore arm or pier to the westward with an opening between the piers and the breakwater. By 1832 the sum of $28,439.84 had been expended on the original plan.

Various improvements and repairs were made from time to time, and by 1838 there had been completed 2,125 feet of breakwater and 300 feet of detached breakwater. In 1848 the breakwater was demolished.

In 1870 a Board of Engineer Officers took into consideration the question of the radical improvement of the harbor. The Board recommended a plan which provided a breakwater 2,860 feet long, one part of which, 2,300 feet in length, was to be nearly parallel with the shore, the outer part, 560 feet long, was to be nearly parallel to the axis of the channel entrance. A channel was to be dredged to secure a depth of 13 feet and a width of 170. Of the 2,300-foot section 1,991 feet has been finished. None of the 560-foot section has been built.

Work during the year consisted in the building of an extension of 400 feet to the breakwater. This was finished on April 11, 1895. The breakwater is now in good condition for its present length. The channel has been dredged under contract in 1894 for its entire length of about 2,800 feet and throughout its width of 120 feet to the required depth of 13 feet.

The pier has its full length and is in a reasonably good condition. The total amount expended up to June 30, 1894, was $529,457.97. The amount expended during the fiscal year ending June 30, 1895, was $21,818.85.

July 1, 1894, balance unexpended	$4,621.41
Amount appropriated by act of August 17, 1894	20,000.00
	24,621.41
June 30, 1895, amount expended during fiscal year	21,818.85
July 1, 1895, balance unexpended	2,802.56
July 1, 1895, outstanding liabilities	15.00
July 1, 1895, balance available	2,787.56

Amount (estimated) required for completion of existing project	108,116.41
Amount that can be profitably expended in fiscal year ending June 30, 1897	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix N N 3.)

4. Buffalo Harbor, New York.—The original project for the improvement of this harbor was adopted in 1826 and provided at first for the

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construction of piers on the north and south sides of Buffalo Creek. Subsequently a masonry sea wall running south from the shore end of the south pier was proposed and built. In 1868 a detached breakwater about 2,500 feet lakeward from the light-house, to extend south a distance of 4,000 feet, was proposed and adopted. In 1874 it was determined to extend this breakwater to a total length of 7,600 feet. This breakwater has now its full proposed length, the final extension of 806 feet having been built in 1893, it runs parallel to the shore and about half a mile distant from it. In 1874 it was also proposed to build a shore arm to the breakwater, the inshore end to consist of pile work near shore and crib work in the deeper water. Upon reaching the 16-foot contour line in the lake this shore arm was planned to continue in a direction making an angle of about 45° with the shore and to overlap the south end of the breakwater, leaving an opening of 150 feet. This shore arm would be about 4,100 feet long.

Minor repairs have been made during the year to the old portions of the breakwater and to the south pier. A new survey of the harbor and its vicinity was finished, including borings south of the breakwater.

The total amount expended up to June 30, 1894, not including outstanding liabilities, was $2,717,404.33. The amount expended during the fiscal year ending June 30, 1895, was $9,779.29.

The river and harbor act of August 17, 1894, made provision for survey and preparation of plan for extending the outer breakwater from a point at or near the present outer breakwater southeasterly to a point at or near Stoney Point.

The report of survey and the plan prepared by Major Ruffner under authority of this law were referred to a Board of Engineers, and the report of the Board was approved by the Secretary of War August 1, 1895. The report of the Board, as well as the report of Major Ruffner, is submitted herewith.

July 1, 1894, balance unexpended	$74,266.73
Amount appropriated by act of August 17, 1894	70,000.00
	144,266.73
June 30, 1895, amount expended during fiscal year	9,779.29
July 1, 1895, balance unexpended	134,487.44
July 1, 1895, outstanding liabilities	200.00
July 1, 1895, balance available	134,287.44
Amount (estimated) required for completion of existing project	400,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	100,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix N N 4.)

5. Tonawanda Harbor and Niagara River, New York.—The project for this work contemplates a channel 18 feet deep and 400 feet wide from the entrance to the Niagara River at Lake Erie to the north end of Tonawanda Harbor, New York. The work of the year has consisted in beginning the dredging to the full width of 400 feet and a depth of 18 feet of the channel at the Strawberry Island Bar. The dredging operations at the Horseshoe Reef Channel have been continued throughout the year, when practicable, and the project at this point is practically complete, securing a channel 400 feet wide and 18 feet deep.

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The amount expended up to June 30, 1894, not including outstanding liabilities, was $222,589.83. The amount expended during fiscal year ending June 30, 1895, was $31,443.91.

July 1, 1894, balance unexpended		$27,410.17
Amount appropriated by act of August 17, 1894		50,000.00
		77,410.17
June 30, 1895, amount expended during fiscal year		31,443.91
July 1, 1895, balance unexpended		45,966.26
July 1, 1895, outstanding liabilities	$6,500.00	
July 1, 1895, amount covered by uncompleted contracts	39,466.26	
		45,966.26

Amount (estimated) required for completion of existing project	958,090.16
Amount that can be profitably expended in fiscal year ending June 30, 1897	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix N N 5.)

6. Niagara River from Tonawanda to Port Day (Niagara Falls), N. Y.—Under provisions of act of September 19, 1890, a survey of this locality was made by Maj. Amos Stickney, Corps of Engineers, and his report thereon of December 31, 1891, with project for improvement, was submitted to Congress and printed as House Ex. Doc. No. 67, Fifty-second Congress, first session (reprinted as Appendix N N 9, Annual Report, Chief of Engineers, 1892). This project contemplated the formation of a channel 300 feet wide from Tonawanda down to Connors Island, 200 feet wide from Connors Island to Grass Island, and increasing from 200 to 400 feet wide from Grass Island to Port Day; and construction of an embankment, from rock excavated from the channel, extending from Connors Island to Port Day, so as to inclose the lower end of the channel.

A channel of 12 feet depth was proposed, although it was incidentally estimated that a channel of 8 feet depth could be first provided, which could be enlarged as an increase of commerce might demand. The cost of the proposed channel, 8 feet deep at mean lake level (6 feet at low lake level), was estimated at $257,829.

The river and harbor act approved July 13, 1892, appropriated $20,000 for the commencement of work upon the 8-foot channel.

During the season of 1892 the practicability of constant navigation of Niagara River by vessels of upward of 6 feet draft to the harbor back of Connors Island, which is within easy land communication with Port Day, was demonstrated. These commercial developments showed that adherence to the project would accomplish no results useful to navigation, and that a modification of the project would be desirable, looking to the excavation of a channel 12 feet deep down to Connors Island, and omitting the work proposed below that point to Port Day. For these reasons expenditure of the appropriation of July 13, 1892, was, under the authority of the Secretary of War, suspended. Congress subsequently adopted the suggested plan by making, August 17, 1894, an appropriation of $10,000 for obtaining a channel 12 feet deep to Schlosser's dock. On May 31, 1895, three cuts affording a channel 50 feet wide and 14 feet deep at mean lake level were completed, and at the close of the fiscal year the channel had been increased in width to 70 feet, at full depth, throughout the entire length of the shoal at the head of Connors Island.

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July 1, 1894, balance unexpended	* $20,000.00
Amount appropriated by act of August 17, 1894	10,000.00
	30,000.00
June 30, 1895, amount expended during fiscal year	8,315.77
July 1, 1895, balance unexpended	21,684.23
July 1, 1895, outstanding liabilities	$3,577.50
July 1, 1895, amount covered by uncompleted contracts	18,106.73
	21,684.23

Amount (estimated) required for completion of existing project	200,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix N N 6.)

7. *Wilson Harbor, New York.*—The project for the improvement of this harbor was adopted in 1873 and modified in 1877, the object being to afford a channel of navigable width and 12 feet in depth by the extension of parallel piers from the mouth of Twelve-Mile Creek to the 12-foot curve in Lake Ontario, with the formation of a protected channel between the piers. The mouth of the creek was originally obstructed by a bar upon which there was a depth of 1 foot. Before the commencement of operations by the United States the piers had been carried about 400 feet into the lake by private enterprise. There is now a channel with only 8.5 feet depth. The total amount expended to June 30, 1894, was $64,978.51.

July 1, 1894, balance unexpended	$21.49
July 1, 1895, balance unexpended	21.49

Amount (estimated) required for completion of existing project	14,069.51
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

(See Appendix N N 7.)

8. *Olcott Harbor, New York.*—The project for the improvement of this harbor was adopted in 1866. It proposes to connect the deep water in Lake Ontario with the deep water in Eighteen-Mile Creek, by the extension of two parallel piers from the mouth of the creek to the 11-foot curve in the lake, with the addition of a dredged channel between the piers. The project was modified in 1874 and in 1881 to provide for the removal of rock found in the channel between the piers and for additional pier extension. The natural channel between the mouth of the creek and the lake was obstructed by a bar upon which there was a depth of 1½ feet. The final project, adopted June 18, 1891, definitely fixes the length of the piers at 850 and 873 feet, respectively, and provides for a channel 180 feet wide, between the piers, decreasing in width to 98 feet at the Main Street Bridge crossing Eighteen-Mile Creek, with a depth of 13.5 feet at mean lake level.

There was no work done during the year. The total amount expended up to June 30, 1894, was $157,623.77. The amount expended during the fiscal year ending June 30, 1895, was $67.59.

July 1, 1894, balance unexpended	$5,376.23
June 30, 1895, amount expended during fiscal year	67.59
July 1, 1895, balance unexpended	5,308.64
July 1, 1895, outstanding liabilities	15.00
July 1, 1895, balance available	5,293.64

(See Appendix N N 8.)

* Reappropriated August 17, 1894.

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9. Oak Orchard Harbor, New York.—The earliest project for the improvement of this harbor was adopted in 1836, the date of the first appropriation, and proposed the construction of an east and west breakwater, approaching to within 200 feet of each other, and connecting at the opening with two parallel piers extending into the lake.

Subsequent modifications were extensions to the original project to provide for removal of rock and to adjust the harbor to the increased demands of commerce.

The present project was adopted in 1881, the object being to extend the piers to the 12-foot curve in the lake, with the formation of a channel of navigable width and 12 feet deep at low water between the piers. The natural entrance into Oak Orchard Creek was narrow, with a depth of 2 to 4 feet.

A shore protection 91 feet long was built in 1888 to the east of the east pier.

The total amount expended up to June 30, 1894, was $204,537.66. The amount expended during the fiscal year ending June 30, 1895, was $30.

July 1, 1894, balance unexpended	$462.34
June 30, 1895, amount expended during fiscal year	30.00
July 1, 1895, balance unexpended	432.34
July 1, 1895, outstanding liabilities	7.50
July 1, 1895 balance available	424.84

(See Appendix N N 9.)

EXAMINATION MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examination of *Dunkirk Harbor, New York*, required by the act of August 17, 1894, was made by the local engineer, Maj. E. H. Ruffner, Corps of Engineers, and his report of September 11, 1894, submitted through the division engineer, Col. H. L. Abbot, Corps of Engineers. It is the opinion of Major Ruffner that the locality is worthy of improvement with a view of securing a depth of 16 feet, and estimates that the survey necessary to the preparation of plan and estimate for improvement will cost $800; but the division engineer dissents from the views of Major Ruffner, and, in his opinion, the harber is not worthy of improvement by the General Government to the extent of obtaining a navigable depth of 16 feet. In the opinion of this office Dunkirk Harbor is worthy of improvement, and it is recommended that the survey proposed by Major Ruffner, at a cost of $800, be made. The report was transmitted to Congress and printed in House Ex. Doc. No. 77, Fifty-third Congress, third session. (See also Appendix N N 10.)

IMPROVEMENT OF HARBORS ON LAKE ONTARIO EAST OF OAK ORCHARD, NEW YORK.

This district was in the charge of Capt. Dan C. Kingman, Corps of Engineers; Division Engineer, Col. Henry L. Abbot, Corps of Engineers.

1. Harbor at Charlotte, N. Y.—The original project for the improvement of this harbor, adopted in 1829, proposed to connect the deep water in the Genesee River with the deep water in the lake by parallel piers or jetties about 480 feet apart. The present project, adopted in 1881, is to extend the jetties to the 15-foot curve in the lake and to dredge a channel between them of navigable width and 15 feet depth at low water. The natural channel was tortuous, and in calm weather would, at ordinary stages of the lake, admit vessels drawing 8 feet.

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The total amount expended from 1828 to June 30, 1895, is $500,904.36. The amount expended from the adoption of the present project in 1881 to June 30, 1895, is $182,826.04.

This expenditure has resulted in the construction of 7,057 linear feet of jetty work, of which 4,975 feet is now valuable and necesssary to the maintenance of the harbor. The rest of it has been absorbed by the advance of the shore line, and further repairs to it will probably not be necessary.

Five thousand feet of jetty, in round numbers, therefore must be kept in good order. This work is of timber filled with stone. The portion of it that is above water is subject to decay. Its useful life is from twelve to fifteen years.

The channel between the jetties had been dredged to a depth of 15 feet in 1892 at extreme low water in the lake for a width of 380 feet. A recent examination shows that this work is not permanent, the current of the river not being sufficient to maintain this depth. Choice will have to be made between periodical dredging and some form of channel contraction. The former method is being resorted to at present.

This expenditure has also sufficed for the protection, preservation, and repair of the existing works and the renewal of the perishable portions from the beginning of the improvement in 1829 to the present time.

July 1, 1894, balance unexpended	$2,631.64
Amount appropriated by act of August 17, 1894	15,000.00
	17,631.64
June 30, 1895, amount expended during fiscal year	9,062.78
July 1, 1895, balance unexpended	8,568.86
July 1, 1895, outstanding liabilities	691.56
July 1, 1895, balance available	7,877.30
Amount (estimated) required for completion of existing project	94,650.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	15,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix O O 1.)

2. Pultneyville Harbor, New York.—The project for the improvement of this harbor was adopted in 1870, the date of the first appropriation, and proposed the construction of a timber breakwater running eastward from the west shore and then northward as a jetty into the lake, also an east jetty parallel to and about 200 feet from the west one, and a dredged channel between them. The project was modified in 1875 to provide for increased dredging. The object of the improvement was to provide a channel of navigable width and not less than 10 feet deep through the bar and into the mouth of Salmon Creek, which was the harbor. The natural channel was not much more than 2 feet deep.

In 1884 it was proposed, in order to make dredging of permanent value and effect, to build a sand-tight structure parallel to the breakwater and about 100 feet from it between it and the beach, so as to arrest the movement of the beach sand and keep it out of the channel.

The total amount expended to June 30, 1895, is $74,459.90, and has resulted in the extension of the jetties to the 10-foot curve in the lake and in the construction of about 200 feet of sand-tight bulkhead and in a large amount of dredging in the channel. The last work of this kind was done by the United States dredging plant belonging to this district during the month of May, 1893. Ten thousand seven hundred and six cubic yards of material was removed, forming a good channel

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from the lake between the piers and up the creek as far as the wharves and warehouses. This channel has a depth of about 10 feet at low water in the lake.

The depth diminishes somewhat in the extreme inner portions of the harbor on account of the rock bottom.

A recent survey shows that the sand-tight bulkhead in its unfinished condition is not long enough to keep the channel open. There is some shoaling beyond the end of it. Tongued and grooved piling sufficient for a hundred-foot extension is now on hand and will be driven this season.

It should be extended to the full extent called for by the project.

The expenditures have resulted in the construction of 1,460 linear feet of pier and jetty work, all of which is now valuable and necessary to the maintenance of the harbor. This work is of timber filled with stone. The portion of it that is above water is subject to decay. Its useful life is from twelve to fifteen years.

July 1, 1894, balance unexpended	$24.67
Amount appropriated by act of August 17, 1894	1,500.00
	1,524.67
June 30, 1895, amount expended during fiscal year	476.57
July 1, 1895, balance unexpended	1,048.10
Amount (estimated) required for completion of existing project	7,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	1,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix O O 2.)

3. Harbor at Great Sodus Bay, New York.—The earliest project for the improvement of this harbor, adopted in 1828, proposed the construction at the mouth of the bay of breakwaters from the east and west shores, approaching to within 500 feet of each other and connected at the opening with parallel jetties extending into the lake.

The subsequent modifications were simply extensions of the original project to adjust it to the increased demands of commerce. The present project was adopted in 1882, the object being to extend the jetties to the 15-foot curve in the lake, and to dredge a channel between them not less than 15 feet deep at extreme low water. The natural channel at ordinary stages would admit vessels drawing 8 feet.

The total amount expended from 1829 to June 30, 1895, is $458,194.13. The amount expended from 1881 to June 30, 1895, is $85,370.31. The total expenditure has resulted in the construction of a timber breakwater 3,851 feet in length, and of two jetties 1,580 feet and 1,294 feet in length, the west one extending to the 15-foot curve in the lake, and the east one to the 10-foot curve.

It has also served for the protection, preservation, and repair of these works from 1829 to the present time, and for dredging from time to time, which has served to maintain a channel of navigable width between the jetties which has varied at different times from 8 to 15 feet in depth at low water.

The present available depth is not less than 13 feet at low water. There is now 4,800 linear feet of jetties and breakwaters at this place that are valuable and necessary to the maintenance of the harbor. The remainder has been absorbed by the advance of the shore line. This work must be kept in repair. As it is built of timber and filled with stone, the part above water is subject to decay. Its life is from twelve to fifteen years.

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July 1, 1894, balance unexpended	$31.99
Amount appropriated by act of August 17, 1894	15,000.00
	15,031.99
June 30, 1895, amount expended during fiscal year	5,547.33
July 1, 1895, balance unexpended	9,484.66
Amount (estimated) required for completion of existing project	28,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix O O 3.)

4. Harbor at Little Sodus Bay, New York.—The first project for the improvement of this harbor was adopted in 1829, and has since been variously modified.

The first appropriation was made in 1852. The first project proposed to partially close the opening between the bay and the lake by lateral dikes connected with two parallel jetties extending into the lake.

The present project, which is simply an expansion of the earlier ones, was adopted in 1881, and is designed to afford a channel of navigable width and not less than 15 feet deep at low water by extending the jetties and dredging between them. The original entrance into the bay had a depth of about 1½ feet at extreme low water.

The total amount expended from the date of the first appropriation in 1852 to June 30, 1895, is $317,772.94.

The amount expended from the adoption of the present project in 1881 to June 30, 1895, is $83,331.17.

The total expenditure has resulted in the construction of 5,989 feet of dikes and jetties, which completes the dike work and extends the jetties to the 12-foot curve in the lake. It has also served for the protection, preservation, and repair of these works from the time they were built to the present time.

A narrow channel 15 feet deep has been dredged through the hardpan bar across the entrance to the channel.

A contract has been made for dredging a wide channel through this hardpan with the funds now available.

Of the dike and jetty work some 4,900 linear feet is still valuable and necessary to the maintenance of the harbor. The rest has been absorbed by the advance of the shore line.

This work is built of timber and filled with stone. The part that is above water is subject to decay. Its useful life is from thirteen to sixteen years.

July 1, 1894, balance unexpended	$122.16
Amount appropriated by act of August 17, 1894	8,000.00
	8,122.16
June 30, 1895, amount expended during fiscal year	953.33
July 1, 1895, balance unexpended	7,168.83
Amount (estimated) required for completion of existing project	44,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	8,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix O O 4.)

5. Oswego Harbor, New York.—The earliest project for the improvement of this harbor was adopted in 1827, and proposed to inclose an area at the mouth of the Oswego River by extending jetties from the

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shore into the lake, joining the outer ends by a breakwater, and leaving an opening through which to enter the harbor.

This project was completed in 1869, and forms the present inner harbor.

The present project was adopted in 1870, and consists of a breakwater 5,800 feet in length, generally parallel to the old west breakwater, and 1,100 feet in advance of it. The estimated cost was $1,161,682. This estimate, of course, did not include its subsequent repairs and maintenance. This project was afterwards modified by the proposed construction of an east breakwater 2,700 feet in length; the reduction to 350 feet of the opening between the east end of the west breakwater and the north end of the light-house pier; the construction of spurs along the face of the outer west breakwater to reduce the effect of accumulated seas, and to provide for deepening by dredging the inner harbor at the mouth of the Oswego River.

The act of Congress of August 11, 1888, provided for the removal of the outer east breakwater, of which 250 feet had been built.

This has been done, and the construction of an east breakwater now forms no part of the project.

In 1890 the project was further modified by providing for the protection and permanent maintenance of an opening that had been formed by waves in a storm through the outer breakwater near the western angle, the object of this opening being to keep the water in the harbor pure by allowing a circulation through it, and to provide another entrance for small vessels.

The natural entrance to the mouth of the river was shallow and difficult of access, and afforded very little shelter to vessels of any considerable size.

The sundry civil act approved March 3, 1893, authorized the unexpended balance of the current appropriation to be applied to the removal of rock within the harbor lines to a uniform depth. A project was therefore prepared for the removal of about 3,000 cubic yards of solid rock from the bed of the river near its mouth, so as to secure a uniform depth of 15 feet at extreme low water in this portion of the harbor. This project was completed in 1893 by the removal of 3,170 cubic yards, at a cost of $8,957.50, and in 1894 and 1895 this depth was still farther extended 93 feet up the river by the removal of about 3,000 yards more of solid rock.

The improvement has been very beneficial to the harbor, and has given a marked impetus to its commerce.

The object of all these improvements has been to give protection and shelter to the city docks and wharves and to the commerce of the harbor, and to make a depth suitable for the deepest-draft vessels on the lake.

The total amount expended since the adoption of the first project in 1827 is $1,823,356.84.

The amount expended from the adoption of the present project in 1870 is $1,349,976.14.

The total expenditure has resulted in the completion of the original project of 1827, and in the construction of the outer west breakwater; the reduction to 350 feet of the opening between the east end of this breakwater and the north end of the light-house pier; the construction and removal of about 250 feet of the east breakwater; the completion of two spur cribs, and the deepening of the river mouth to a depth of 15 feet at low water; in the securing of full protection to the dock and wharves west of the river mouth, and channels of entrance 16 feet deep

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and 350 feet wide to the inner and outer harbors, and in securing increased depth in the inner harbor.

In addition, the various works have been cared for and maintained and the perishable portions renewed when necessary from the beginning of the work in 1829 to the present time.

The operations of the fiscal year have been the rock excavation before described and certain necessary repairs to the breakwater and the plant belonging to the work.

The outer breakwater suffered a serious injury from storms during the past winter. Fortunately, the injuries are confined to a single place, just west of the second spur crib.

A special appropriation was made in the act of August 17, 1894, of $10,000 for the repair of this breach, and it was thoroughly closed and repaired.

There has been constructed here 8,776 linear feet of piers and breakwaters, of which 6,465 feet is valuable and necessary to the maintenance of the harbor. The rest has been superseded by the later works.

It is all built of timber and filled with stone. The part above water is subject to decay. Its useful life is from twelve to fifteen years.

The superstructure required here is very expensive, owing to its exposure. It cost about $40 a running foot.

By the terms of the sundry civil act of March 2, 1895, the Secretary of War was authorized and directed, in his discretion, to expend from the appropriation for improvement of the harbor at Oswego a sum not to exceed $800 for the purpose of making a survey, examination, and preparation of project for the construction of an east breakwater or jetty at the mouth of the Oswego River for the protection of the harbor and to render entrance to it easy and safe.

The duty of making the survey and preparation of plan thus provided for was assigned to Captain Kingman, who submitted his report on the subject under date of June 8, 1895. He proposes the construction of a curved jetty, to terminate upon the line of the outer breakwater prolonged and 500 feet from it, leaving an entrance 500 feet wide into the harbor, the jetty to start in comparatively shallow water, where a sufficient opening is to be left to allow the circulation of water and permit the passage of small boats and tugs. The estimated cost of the work is $197,000.

July 1, 1894, balance unexpended	$5,522.58
Amount appropriated by act of August 17, 1894	37,000.00
	42,522.58
June 30, 1895, amount expended during fiscal year	23,248.72
July 1, 1895, balance unexpended	19,273.86
July 1, 1895, outstanding liabilities	27.25
July 1, 1895, balance available	19,246.61
Amount (estimated) required for completion of existing project	85,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	35,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix O O 5.)

6. Harbor at Sacketts Harbor, New York.—The project for the improvement of this harbor was adopted in 1881, and proposed the deepening of the harbor by dredging over an area of about 15 acres to a depth of 12 feet at low water. The depth previously existing was less than 8 feet over a large part of this area.

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In 1826 and 1828 the sum of $6,000 was expended in clearing and deepening this harbor. The total amount expended from 1826 to June 30, 1895, is $14,720.76.

The amount expended from the adoption of the present project to June 30, 1895, is $8,720.76, and has resulted in the removal of 24,010 cubic yards of sand, mud, and gravel from the harbor and in the construction of a stake and fascine dike 164 feet in length, with a mooring crib 18 feet square at its extremity to shelter the basin and exclude gravel drift from it. With the completion of this work the harbor has a depth of 12 feet at low water over about 6 acres of its area, except in a small place where the presence of rock in place limited the depth to a little less than 12 feet.

The harbor is formed by a natural spur of loose stone and gravel about 800 feet in length extending in an easterly direction from the shore, so as to form a small sheltered bay, and the existence of the harbor depends upon the preservation of this natural breakwater.

The present appropriation ($5,000) will be applied to the protection of this spur by the construction of a rough wall of blocks of stone of one or more tons in weight, built parallel to the shore line, and from 50 to 100 feet in advance of it, where the water is about 6 feet deep.

This work will finish the existing project.

July 1, 1894, balance unexpended	$317.74
Amount appropriated by act of August 17, 1894	5,000.00
	5,317.74
June 30, 1895, amount expended during fiscal year	38.50
July 1, 1895, balance unexpended	5,279.24

(See Appendix O O 6.)

EXAMINATION MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examination of *channel connecting Irondequoit Bay with Lake Ontario, New York*, required by the act of August 17, 1894, was made by the local engineer, Capt. Dan C. Kingman, Corps of Engineers, and report thereon, dated January 21, 1895, submitted through the division engineer, Col. H. L. Abbot, Corps of Engineers. In the opinion of Captain Kingman, the locality is not worthy of improvement by the General Government, and his views are concurred in by the division engineer and by this office. The report was transmitted to Congress and printed in House Ex. Doc. No. 300, Fifty-third Congress, third session. (See also Appendix O O 7.)

IMPROVEMENT OF RIVERS AND HARBORS IN VERMONT AND NORTHERN NEW YORK.

This district was in the charge of Capt. Smith S. Leach, Corps of Engineers; Division Engineer, Col. Henry L. Abbot, Corps of Engineers.

1. Shoals between Sister Islands and Crossover Light, St. Lawrence River, New York.—The act of August 11, 1888, provided for a survey of the shoals described, which being made, a report was submitted July 2, 1889, and printed in the Annual Report of the Chief of Engineers, 1889, pages 2463 and 2464. The estimate of cost was $43,305 for a total volume of 2,077 cubic yards of rock to be removed, affording a draft of 18 feet at low water.

Appropriations of $5,000 in 1890 and $10,000 in 1892 were made. Two contracts already completed have accomplished the removal of the

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smaller two of the three shoals included in the project. Two outlying spurs of one of these shoals, not detected by the first survey, have been included in the project, increasing it to 2,627 cubic yards, and a pro rata revised estimate of $54,772 has been adopted.

In the summer of 1893 a resurvey of this stretch of the St. Lawrence was made by an exhaustive application of the method of continuous sweeping, resulting in the discovery of several small points of rock projecting from the bottom of the channel to heights sufficient to be a menace to vessels. As the appropriation in act of August 17, 1894, together with the available balance of former appropriations, was insufficient for the removal of the large shoal, which is now all that remains to be done of the project of 1889, work under that project was temporarily postponed, and a new project, providing for the removal of the most dangerous of these new shoals, was adopted.

Bids for the execution of the work were opened January 17, 1895, and a contract was made with the lowest bidders for the removal of 600 cubic yards, more or less, at $8.49 per yard. The contract requires the work to be completed by November 30, 1895.

July 1, 1894, balance unexpended	$3,186.50
Amount appropriated by act of August 17, 1894	8,000.00
	11,186.50
June 30, 1895, amount expended during fiscal year	867.94
July 1, 1895, balance unexpended	10,318.56
July 1, 1895, amount covered by uncompleted contracts	6,810.00
July 1, 1895, balance available	3,508.56

Amount (estimated) required for completion of existing project	29,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	8,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix P P 1.)

2. Ogdensburg Harbor, New York.—The improvement of this harbor has been carried on under three successive projects, covering substantially the same area, but providing for a progressive deepening to meet the increasing demand of commerce for draft of water. The last of these projects now in execution was adopted in 1890, and contemplates the deepening of the channels leading from the deep water of the St. Lawrence River and along the city front to 16½ feet at extreme low water, at an estimated cost of $158,950. Prior to improvement depths of 5 to 12 feet prevailed along the city front. There is now a channel 150 feet wide with a clear depth of 16½ feet at extreme low water along the greater part of the city front and across the mouth of the Oswegatchie, and a narrow cut along each side of that stream to reach important terminals. These channels are accessible from the river through two entrances carrying 16½ feet or more. One of these entrances has been shown by a recent survey to be narrow and tortuous by reason of the encroachment of drifting sands.

Bids were opened October 5, 1894, for work under the appropriation of $20,000 in act approved August 17, 1894, and a contract was entered into for dredging 5,000 cubic yards, more or less, of hardpan at 35 cents, and 160,000 cubic yards, more or less, of mud at 10 cents, per yard. The contract calls for the completion of this work by November 30, 1895.

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July 1, 1894, balance unexpended		$947.10
Amount appropriated by act of August 17, 1894		20,000.00
		20,947.10
June 30, 1895, amount expended during fiscal year		7,636.85
July 1, 1895, balance unexpended		13,310.25
July 1, 1895, outstanding liabilities	$3,391.19	
July 1, 1895, amount covered by uncompleted contracts	9,919.06	
		13,310.25

Amount (estimated) required for completion of existing project	56,950.00
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	20,000.00

(See Appendix P P 2.)

3. Breakwater at Rouse Point, Lake Champlain, New York.—The project for this improvement was adopted in 1885, and comprised a straight breakwater composed wholly of stone, with a total length of about 2,000 feet, reaching the 18-foot curve in the lake. The estimated cost was $110,000, or $55 per linear foot.

Appropriations made in 1884, 1886, 1888, 1890, and 1892, aggregated $98,500, and under contracts of corresponding years the breakwater has been completed. Its total length is 1,835 feet, the 18-foot curve having drawn inshore since the preliminary survey on which the estimate was based. The actual expenditures divided by this length give a cost per linear foot of less than $54, as compared with $55 estimated nine years ago.

July 1, 1894, balance unexpended	$65.71
June 30, 1895, amount expended during fiscal year	33.26
July 1, 1895, balance unexpended	32.45

(See Appendix P P 3.)

4. Great Chazy River, New York.—A survey of this stream from its mouth, on Lake Champlain, to Champlain village was provided for in the act of 1888. The report made was printed in the Report of the Chief of Engineers for 1889, page 2466.

The project adopted was to dredge a channel between the points named in the act 40 feet wide and 5 feet deep, at a cost of $18,000. The acts of 1890 and 1892 appropriated $15,000 to this improvement, which was expended under contract in accordance with the project.

An appropriation of $3,000 was made in the act of August 17, 1894, which will be expended under a contract made with the lowest bidder, and which will complete the project.

July 1, 1894, balance unexpended	$339.35
Amount appropriated by act of August 17, 1894	3,000.00
	3,339.35
June 30, 1895, amount expended during fiscal year	55.20
July 1, 1895, balance unexpended	3,284.15
July 1, 1895, amount covered by uncompleted contracts	3,284.15

(See Appendix P P 4.)

5. Plattsburg Harbor, New York.—This work has been intermittently prosecuted since 1836. Under the project adopted and subsequent modifications a breakwater of a permanent and substantial character 1,850 feet in length has been completed. This structure is believed to afford sufficient shelter for the present needs of commerce. In addition to the breakwater, some dredging has been done in the anchorage,

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and a short length of wasting beach has been protected. The total cost of the improvement has been $185,440.76.

July 1, 1894, balance unexpended	$267.97
June 30, 1895, amount expended during fiscal year	28.72
July 1, 1895, balance unexpended	239.25

(See Appendix P P 5.)

6. *Burlington Harbor, Vermont.*—This improvement dates from 1836, modifications of the original plan having been made from time to time so as to afford adequate protection to the increasing commercial and shipping interests of the harbor. The last modification, made in 1886, provides for farther extension of the breakwater, both to the north and to the south, with its gradual withdrawal as it is prolonged into water about 30 feet deep, so as to reduce the cost.

The old parts of the superstructure are much decayed, and the appropriation in act of August 17, 1894, together with the balance of the appropriation of 1890, $25,565.65 in the aggregate, will be expended under contract in recapping with stone a length of 990 feet of the oldest and weakest portion. Work under this contract is to be completed by June 30, 1896.

July 1, 1894, balance unexpended	$15,565.65
Amount appropriated by act of August 17, 1894	10,000.00
	25,565.65
June 30, 1895, amount expended during fiscal year	452.99
July 1, 1895, balance unexpended	25,112.66
July 1, 1895, amount covered by uncompleted contracts	25,112.66
Amount (estimated) required for completion of existing project	129,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix P P 6.)

7. *Otter Creek, Vermont.*—The object of this improvement is to afford a channel of navigable width and a depth of 8 feet at low water from the town of Vergennes, Vt., to Lake Champlain. The original project was adopted in 1872, and was estimated to cost $58,146. In 1882 surveys developed the fact that rock in situ would be encountered within the proposed limits of width and depth, and the estimate was increased to $73,748.40. In 1884 a relocation of the channel at Bull Brook Bend avoided a part of the rock excavation, reducing the cost by about $500, and the lower prices which have prevailed in recent years have insured the completion of the project for less than the revised estimate of 1882.

Occasional expenditures for maintenance will doubtless be required. It has been found necessary to repeat operations at Bull Brook Bend, and it is quite probable that accretions will again occur on the shoals there and elsewhere during the season of freshets. Such costs of maintenance will not, it is believed, be excessive in relation to the first cost of the improvement, and they will be very small as compared with the traffic benefited.

During the last fiscal year the completed channel reached the public landing, and the amount yet to be appropriated under the revised estimate will suffice to complete the project.

Under the appropriation of $5,000 in act of August 17, 1894, a contract has been entered into for the removal of 1,160 cubic yards of

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rock, more or less, at $5 per yard. This work is to be completed by September 1, 1895, and will consume all available funds.

July 1, 1894, balance unexpended	$1,551.37
Amount appropriated by act of August 17, 1894	5,000.00
November 14, 1894, overpayment refunded	43.40
	6,594.77
June 30, 1895, amount expended during fiscal year	235.65
July 1, 1895, balance unexpended	6,359.12
July 1, 1895, amount covered by uncompleted contracts	6,359.12
Amount (estimated) required for completion of existing project	15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix P P 7.)

8. Ticonderoga River, New York.—The project for this improvement was adopted in 1881, its object being to afford a channel of navigable width and a least depth of 8 feet at low water from Ticonderoga village to Lake Champlain, a distance of about 2 miles. The original estimated cost of the improvement was $42,516.

The appropriation of September 19, 1890, $2,000, was expended under contract, and operations consisted in dredging and removal of 8,132 cubic yards of material from shoals near the mouth of the river.

Amount (estimated) required for completion of existing project	$26,016.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

(See Appendix P P 8.)

9. Narrows of Lake Champlain, New York and Vermont.—The original project for this work was adopted in 1885, and had for its object the removal of such obstructions in the channel between Whitehall, N. Y., and a point a mile below, known as the Elbow, as would afford a least depth of 12 feet with a least width of 150 feet, and the dredging of the channel along Cedar Mountain and across Kenyon Bay so as to afford a least depth of 12 feet and a width of 200 feet. The estimated cost was $80,000.

Under appropriations in 1886 and 1888, aggregating $45,000, the project was completed, and the resulting channel being found deficient in width at certain sharp bends, a supplementary project was adopted, involving dredging, at an estimated cost of $21,000.

The act of 1892 contained an appropriation of $18,500, making with the balance in hand a sum sufficient to complete the project, which was placed under contract.

As the work apparently necessary at the points named in the contract did not reach the estimated quantities, a considerable balance of funds remains available for relief at other localities when it may be needed.

July 1, 1894, balance unexpended	$5,598.81
July 1, 1895, balance unexpended	5,598.81

(See Appendix P P 9.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations of the following localities, required by the act of August 17, 1894, were made by the local engineer, Capt. S. S. Leach, Corps of Engineers, and reports thereon submitted through the division engineer, Col. H. L. Abbot, Corps of Engineers:

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1. Preliminary examination of Waddington Harbor, New York.—Captain Leach submitted report of examination October 27, 1894. It is his opinion, concurred in by the division engineer and by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 18, Fifty-third Congress, third session. (See also Appendix P P 10.)

2. Preliminary examination of Missisquoi River, Vermont, particularly between the village of Swanton and the lake.—Captain Leach submitted report of examination October 27, 1894. In his opinion the locality is worthy of improvement. The division engineer considers that the facts stated in the accompanying report "warrant a survey and project from which to determine whether the cost will be sufficiently small to make the river worthy of improvement by the General Government," and his views are concurred in by this office. It is estimated that the necessary survey may be made for $500. The report was transmitted to Congress and printed in House Ex. Doc. No. 19, Fifty-third Congress, third session. (See also Appendix P P 11.)

PACIFIC COAST.

IMPROVEMENT OF OAKLAND HARBOR, CALIFORNIA.

This work was in the charge of Col. G. H. Mendell, Corps of Engineers, having under his immediate orders Lieut. Clement A. F. Flagler, Corps of Engineers, to August 10, 1894, and Lieut. Joseph E. Kuhn, Corps of Engineers, since August 6, 1894.

The principal features of this improvement as originally projected are (1) two mid-tide training walls of rubblestone extended from the shore westward into San Francisco Bay about 2 miles; (2) a connection by a canal 1½ miles in length with the estuary of San Leandro; (3) a dam at the mouth of this estuary; (4) dredging of basins and channels to give a depth of 20 feet at low tide, which at high tide will accommodate vessels of the largest class.

Two modifications of the original project have been adopted, namely, to increase the width of tidal canal from 300 to 400 feet and to raise the height of jetties from half-tide level to full high water. In the original condition of the entrance the low-water channel depth was about 2 feet, admitting at time of high tide vessels drawing 6 to 8 feet of water.

The amount expended to June 30, 1894, is $1,619,604.35. The condition as to facility for navigation on June 30, 1894, permitted vessels drawing 19 feet of water to pass from San Francisco Bay to Oakland at ordinary high water. Operations were then in progress to give an increased depth of 6 feet in this channel, and they have since been continued under one contract fulfilled during the year and by a second contract now in process of execution. It will require fully another year's work to extend the depth to San Francisco Bay. The low-water depth of 20 feet now holds over a length of 5,500 feet, to become about 8,500 feet upon fulfillment of existing contract. There is a depth of 18 or 19 feet over 1,800 feet of length, and for the remaining 8,500 feet the low-water depth is 14 feet. The width of this channel is 300 feet. In the upper basin the channel originally made 200 feet wide and 8 feet deep has shoaled by natural causes to the extent of 1 foot or a little more.

During the past year there was dredged from the main channel and deposited ashore 117,316 cubic yards, under the contract of October 8, 1892, and under the contract of December 10, 1894, 203,493 cubic yards.

At the mouth of the canal 29,208 cubic yards was dredged and impounded under the last-named contract.

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July 1, 1894, balance unexpended		$64,995.65
Amount appropriated by act of August 17, 1894		100,000.00
		164,995.65
June 30, 1895, amount expended during fiscal year		102,836.27
July 1, 1895, balance unexpended		62,159.38
July 1, 1895, outstanding liabilities	$9,515.45	
July 1, 1895, amount covered by uncompleted contracts	39,104.89	
		48,620.34
July 1, 1895, balance available		13,539.04

Amount (estimated) required for completion of existing project 741,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897 100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix Q Q 1.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations of the following localities, required by the act of August 17, 1894, were made by the local engineer, Col. G. H. Mendell, Corps of Engineers, and reports thereon submitted:

1. Preliminary examination of Sunken Rocks off Fort Point, in San Francisco Harbor, California.—Colonel Mendell submitted report of examination September 25, 1894. It is opinion, concurred in by this office, that the improvement is not worthy of being undertaken by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 51, Fifty-third Congress, third session. (See also Appendix Q Q 2.)

2. Preliminary examination of Mile Rocks, San Francisco Harbor, California.—Colonel Mendell submitted report of examination October 11, 1894. It is his opinion, concurred in by this office, that under existing circumstances the removal of these rocks is not a worthy improvement. The report was transmitted to Congress and printed in House Ex. Doc. No. 51, Fifty-third Congress, third session. (See also Appendix Q Q 3.)

3. Preliminary examination of Arch Rock, San Francisco Harbor, California.—Colonel Mendell submitted report of examination October 11, 1894. It is his opinion, concurred in by this office, that if the rock is found upon survey to be removable at moderate cost it is a worthy improvement, but its conspicuousness places it out of the class of most dangerous obstructions. The necessary survey is estimated to cost $500. The report was transmitted to Congress and printed in House Ex. Doc. No. 51, Fifty-third Congress, third session. (See also Appendix Q Q 4.)

4. Preliminary examination of Noonday Rocks, San Francisco Harbor, California.—Colonel Mendell submitted report of examination September 21, 1894. In his opinion, concurred in by this office, the harbor is worthy of this improvement, and he estimates that $3,000 will be required for a survey necessary for the preparation of plan and estimate for the removal of these rocks. The report was transmitted to Congress and printed in House Ex. Doc. No. 51, Fifty-third Congress, third session. (See also Appendix Q Q 5.)

5. Preliminary examination of Blossom Rock, San Francisco Harbor, California.—Colonel Mendell submitted report of examination September 21, 1894. In his opinion, concurred in by this office, the harbor is worthy of this improvement, and he estimates that $250 will be required

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for the survey necessary for the preparation of plan and estimate of cost of the improvement. The report was transmitted to Congress and printed in House Ex. Doc. No. 51, Fifty-third Congress, third session. (See also Appendix Q Q 6.)

6. Preliminary examination of Two Mission Rocks, San Francisco Harbor, California.—Colonel Mendell submitted report of examination September 26, 1894. In his opinion, concurred in by this office, the harbor is worthy of this improvement, and he estimates that a survey necessary to the preparation of plan and estimate of improvement will cost $200. The report was transmitted to Congress and printed in House Ex. Doc. No. 51, Fifty-third Congress, third session. (See also Appendix Q Q 7.)

7. Preliminary examination of Shag Rock, San Francisco Harbor, California.—Colonel Mendell submitted report of examination September 21, 1894. It is his opinion, concurred in by this office, that the harbor is worthy of this improvement, and he estimates that $50 will be sufficient to obtain further information required for preparation of plan and estimate of cost of the removal of this rock. The report was transmitted to Congress and printed in House Ex. Doc. No. 51, Fifty-third Congress, third session. (See also Appendix Q Q 8.)

8. Preliminary examination of Anita Rock, San Francisco Harbor, California.—Colonel Mendell submitted report of examination September 21, 1894. It is his opinion, concurred in by this office, that the harbor is worthy of this improvement, and he estimates that a survey necessary for the preparation and estimate for the removal of this rock can be made for $100. The report was transmitted to Congress and printed in House Ex. Doc. No 51, Fifty-third Congress, third session. (See also Appendix Q Q 9.)

9. Preliminary examination of Invincible Rock, Whiting Rock, and Fifteen Foot Rock, known as The Brothers, near Point San Pablo, San Francisco Bay, California.—Colonel Mendell submitted report of examination October 11, 1894. It is his opinion, concurred in by this office, that on account of the magnitude of the commerce concerned San Francisco Harbor is worthy of the improvement due to the removal of these rocks, provided that a survey shall demonstrate this to be a reasonable proposition. He estimates that $300 will be required for survey and estimate of cost of this improvement. The report was transmitted to Congress and printed in House Ex. Doc. No. 51, Fifty-third Congress, third session. (See also Appendix Q Q 10.)

IMPROVEMENT OF RIVERS AND HARBORS IN SOUTHWESTERN ARIZONA AND IN CALIFORNIA SOUTH OF SAN FRANCISCO.

This district was in the charge of Lieut. Col. W. H. H. Benyaurd, Corps of Engineers, with Lieut. Charles L. Potter, Corps of Engineers, under his immediate orders.

1. Napa River, California.—The project for this improvement is to clear the river of snags and the banks of leaning trees liable to interfere with navigation and to dredge a channel through the bars between Carr Bend and Vernon Mills in the immediate vicinity of Napa.

Work upon this improvement was commenced in 1889. A channel was dredged through the different bars between Carr Bend and the highway bridge at Third street and the river was cleared of snags. A recent examination shows that the dredged channel has been filled and that the river is in as bad a condition as before any improvement was commenced. It is not considered that any improvement effected will remain permanent, as a channel dredged one year is liable to be

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refilled with material brought down during the winter floods. As ordinary tides rise 5 feet and spring tides about 7 feet it is possible to keep the river in a good navigable condition with a comparatively small amount of work.

With the appropriation of $4,000 made by the river and harbor act of August 17, 1894, it is proposed during the coming season to dredge a channel through the worst bars immediately in front of the city. For this work a contract was entered into June 17, 1895, at a rate of 29 cents per cubic yard.

The original estimated cost of this improvement, made in 1885, was $27,500, of which $21,500 has been appropriated and $17,491.33 expended.

July 1, 1894, balance unexpended	$19.35
Amount appropriated by act of August 17, 1894	4,000.00
	4,019.35
June 30, 1895, amount expended during fiscal year	10.68
July 1, 1895, balance unexpended	4,008.67
July 1, 1895, amount covered by uncompleted contracts	3,500.00
July 1, 1895, balance available	508.67
Amount (estimated) required for completion of existing project	6,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	4,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix R R 1.)

2. Redwood Creek, California.—There are no funds on hand available for this work, and it is not contemplated to continue the improvement. Under appropriations made for Redwood Harbor and Redwood Creek the channel was dredged several times, but it refilled owing to local causes. It is not possible to maintain a channel, except by constant dredging.

Should the commerce of Redwood City justify the expenditure, appropriations may be needed in the future to continue the improvement.

The total amount appropriated for dredging at Redwood was $23,400. The entire amount has been expended.

July 1, 1894, balance unexpended	$13.51
June 30, 1895, amount expended during fiscal year	13.51

(See Appendix R R 2.)

3. San Luis Obispo Harbor, California.—The project for the improvement of this harbor is intended to protect the anchorage and wharf at Port Harford by the construction of a breakwater on Whaler Reef, extending from Point San Luis to Whaler Island, and thence to a point where the outer reef rises above high water. The total length of the structure when completed will be about 2,300 feet. This limitation as to length was fixed by the provisions of the act authorizing the original survey and estimate. The breakwater will rise to a height of 6 feet above high water, with a thickness on top of 20 feet, and with such slopes on inner and outer sides as may be assumed under the action of the seas.

At the commencement of the fiscal year operations were in progress under a contract which was completed in August. The total amount of rock delivered in the interval between June and August was about 3,875 tons, and the breakwater was extended to a point 510 feet beyond the island.

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With the appropriation of $40,000 made by the river and harbor act of August 17, 1894, a contract was entered into January 19, 1895, for continuing the construction of the breakwater. While towing his plant to the scene of operations in May the contractor met with heavy seas off Point Sur, whereby he lost his outfit of derricks, engines, etc., which necessitated a refitting. This has been done, but by reason of the delay caused by the accident, only a small amount of work had been accomplished at the close of the fiscal year.

During the coming season operations will be carried on under the last-mentioned contract. It is expected when this work is completed that the breakwater will have been extended some 700 feet beyond the island.

The structure, as far as completed, has added to the security of vessels lying at the anchorage and at the wharf at Port Harford.

The total amount appropriated for this improvement is $135,000, and the total amount expended to close of fiscal year, including outstanding liabilities, is $96,550.22.

July 1, 1894, balance unexpended		$11,176.39
Amount appropriated by act of August 17, 1894		40,000.00
		51,176.39
June 30, 1895, amount expended during fiscal year		12,000.23
July 1, 1895, balance unexpended		39,176.16
July 1, 1895, outstanding liabilities	$726.38	
July 1, 1895, amount covered by uncompleted contracts	34,747.12	
		35,473.50
July 1, 1895, balance available		3,702.66
Amount (estimated) required for completion of existing project		468,660.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		40,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix R R 3.)

4. Wilmington Harbor, California.—Previous to the commencement of this improvement in 1871 there was a depth of less than 2 feet at low tide at the entrance. Since that time the operations of jetty construction and dredging have secured a channel depth of 14.6 feet at the entrance at mean low tide, and about 16 feet inside with lesser depths along portions of the wharf fronts.

The original project contemplated gaining a depth of 10 feet at mean low tide. This having been accomplished in 1881, a further project was presented for increasing the depth to 16 feet at same stage, which would permit vessels drawing 20 to 22 feet to enter at high tide. Surveys recently made show a depth of 14.6 feet at the entrance. The changes in depth take place very slowly, and it is ultimately expected that the depth of 16 feet will be attained.

No appropriation having been made for the improvement by the river and harbor act of August 17, 1894, no work was carried on during the year.

A correct chart of harbor lines with description was submitted to the Secretary of War and received his approval May 7, 1895.

The total amount appropriated for this work is $955,000, and the total amount expended to close of fiscal year, including outstanding liabilities, is $951,559.61.

The Senate by resolution of February 6, 1895, having called for information respecting improvement of this harbor, the Secretary of

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War, February 8, 1895, submitted to the Senate a report on this subject prepared by Lieutenant-Colonel Benyaurd, dated June 8, 1894, in which improvements estimated to cost $392,725 are proposed. This report was printed in Senate Ex. Doc. No. 61, Fifty-third Congress, third session; it is also submitted herewith:

July 1, 1894, balance unexpended	$4,861.32
June 30, 1895, amount expended during fiscal year	1,380.93
July 1, 1895, balance unexpended	3,480.39
July 1, 1895, outstanding liabilities	40.00
July 1, 1895, balance available	3,440.39

(See Appendix R R 4.)

5. *San Diego Harbor, California.*—Before the adoption of the present project the work carried on had for its object the preservation of the harbor, which was being injured by the deposition of material brought down the San Diego River during flood stages. A dike was built across the mouth of the river and a new channel excavated, causing the river to empty into False Bay. This work was completed in 1876.

The present project contemplates the preservation and repair of the above dike, the deepening of the channel over the bar to a depth of 26 feet at mean low tide by the construction of a jetty on Zuninga Shoal, and the deepening of the channel through the Middle Ground just within the entrance to the harbor.

At the commencement of the fiscal year work upon the jetty was in progress under contract. The contractor completed his work in July following. This was the first work done upon this improvement. The jetty was carried to a length of 2,472 feet, being built up to high water for 1,860 feet and to low water for 612 feet additional.

Under the appropriation of $50,000 made by the river and harbor act of August 17, 1894, proposals were invited for continuing the construction of the jetty, and a contract was entered into February 2, 1895. The contractor commenced work in April, but, owing to the rejection of the entire number of piles required for the work, active operations were not resumed until June. At the close of the fiscal year the jetty trestle had been advanced a farther distance of 882 feet; the jetty wall was completed to high water for a farther distance of 224 feet, and a foundation course laid for 248 feet additional.

During the coming season work will be continued to the extent of the available funds.

The works as far as constructed have had no effect upon the bar depth, and none is expected until the jetty shall have been extended a considerable distance seaward.

The channel depth at the Middle Ground remains the same as at last reported, viz, 16½ feet at mean low tide. No dredging was done during the past year, nor is any contemplated until the jetty shall have been extended seaward a sufficient length to cut off the movement of sand over Zuninga Shoal.

In January last one of the highest floods known in San Diego River occurred. The levee near its northerly end was overtopped for a length of about 100 feet for a short time and its destruction threatened. Residents in the vicinity whose property was in danger closed the break. The berm, front slope, and stone revetment were damaged, but not seriously enough to affect the stability of the work.

The total amount appropriated for San Diego Harbor since 1875 is $242,500, and the total amount expended, including outstanding

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liabilities, is $202,577.31. Of this latter amount $82,088.02 has been expended upon the dike.

July 1, 1894, balance unexpended		$32,921.65
Amount appropriated by act of August 17, 1894		50,000.00
		82,921.65
June 30, 1895, amount expended during fiscal year		33,060.95
July 1, 1895, balance unexpended		49,860.70
July 1, 1895, outstanding liabilities	$9,938.01	
July 1, 1895, amount covered by uncompleted contracts	35,404.99	
		45,343.00
July 1, 1895, balance available		4,517.70

Amount (estimated) required for completion of existing project	234,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix R R 5.)

6. Colorado and Gila rivers at Yuma, Ariz.—The project for this improvement contemplated the construction of a levee, in length about 3,400 feet, along the easterly boundary of Yuma so as to protect that town from the floods of the Gila River.

The levee was completed in January, 1893. It is now in good condition and no further work is contemplated.

The total amount appropriated for this improvement is $10,000, and the total amount expended is $9,781.75.

July 1, 1894, balance unexpended	$359.91
June 30, 1895, amount expended during fiscal year	141.66
July 1, 1895, balance unexpended	218.25

(See Appendix R R 6.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations of the following localities, required by the act of August 17, 1894, were made by the local engineer, Lieut. Col. W. H. H. Benyaurd, Corps of Engineers, and reports thereon submitted:

1. Preliminary examination of harbor of El Moro, Cal.—Lieutenant-Colonel Benyaurd submitted report of examination December 29, 1894. It is his opinion, concurred in by this office, that the locality is worthy of improvement by the General Government. A survey of the locality is estimated to cost $200. The report was transmitted to Congress and printed in House Ex. Doc. No. 198, Fifty-third Congress, third session. (See also Appendix R R 7.)

2. Preliminary examination of San Rafael Creek, California.—Lieutenant-Colonel Benyaurd submitted report of examination December 5, 1894. In his opinion, concurred in by this office, the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 126, Fifty-third Congress, third session. (See also Appendix R R 8.)

3. Preliminary examination of Suisun Creek, California, with a view to improvement of channel.—Lieutenant-Colonel Benyaurd submitted report of examination January 5, 1895. In his opinion, concurred in by this office, the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 205, Fifty-third Congress, third session. (See also Appendix R R 9.)

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4. Preliminary examination of Napa River, California, between North and South Vallejo, with a view of improvement and confinement of current to keep the channel open.—Lieutenant-Colonel Benyaurd submitted report of examination December 5, 1894. It is his opinion, concurred in by this office, that Napa River, at this point, or Mare Island Strait, as it is properly called, is worthy of improvement by the General Government. The cost of a survey and incidental expenses will not exceed $400. The report was transmitted to Congress and printed in House Ex. Doc. No. 127, Fifty-third Congress, third session. (See also Appendix R R 10.)

Lieutenant-Colonel Benyaurd was also charged with the duty of making preliminary examination of Colorado River, above Yuma, Ariz., to the highest point of navigation, and the report of the results of this examination will be duly submitted when received.

IMPROVEMENT OF SAN JOAQUIN AND SACRAMENTO RIVERS AND TRIBUTARIES AND OF RIVERS AND HARBORS IN CALIFORNIA NORTH OF SAN FRANCISCO.

This district was in the charge of Maj. W. H. Heuer, Corps of Engineers, having under his immediate orders Lieut. G. D. Fitch, Corps of Engineers, to December 22, 1894, and Lieut. Herbert Deakyne, Corps of Engineers, the entire year; Division Engineer, Col. G. H. Mendell, Corps of Engineers.

1. San Joaquin River, California.—Before improvement the low-water channel to Stockton was only 6 feet in depth; the upper river above Stockton was navigable for a few months each year, during the high-water season, and then only for very light-draft boats.

The project for improvement was adopted in 1877 and slightly modified in 1881 and 1888. Its object was to secure and maintain by dredging a channel 9 feet deep at low water and 100 feet wide through the tidal portions of the river and Stockton Slough to Stockton, and a channel 4 feet deep at low water and 100 feet wide to Miller's warehouse in Mormon Slough; to secure the temporary improvement of the low-water channel of the upper river by dredging, scraping, the removal of snags, the construction of small wing dams, and the closure or partial closure of Paradise Cut and Laird Slough. Steamboating to Stockton was thus rendered easy and safe all the year round, but the annual time of navigation in the upper river was not materially lengthened.

During the past year the dredge worked in Stockton Slough 84 days, making cuts aggregating 9,645 feet in length, 50 feet in width, and to a depth of 9 to 10 feet below low water, removing 100,986 cubic yards of material at a cost of $7,637.51, or 7.5 cents per cubic yard. After the dredge was laid up the hull was repaired and contract entered into to put in new boilers.

On October 22, 1894, a contract was entered into for repairing the dam at Laird Slough. The work was completed December 1, 1894, 1,259 linear feet of round piles, 4,624 linear feet of sheet piles, 10,330 feet of wales and braces, 457 tons of stone, and 318 cords of brush being used in the work, which cost, including all incidental expenses, $4,251.10.

From October to December, 1894, during the low-water season, many snags that obstructed navigation in the upper river, from Hills Ferry to the San Joaquin Bridge, were removed by a party working from small skiffs and on foot. Other snags which had formed were removed in May, 1895. The total cost of the snagging was $1,328.45.

Three wing dams were built at the San Joaquin Bridge to concentrate the current into the draw of the bridge and scour a channel there.

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Their cost was $1,328.57. Some small repairs were also made to one dam at Paradise Cut.

The work done during the year has maintained the low-water channel of 9 feet to Stockton, and the upper river has been benefited by the removal of snags and the building of the wing dams at the San Joaquin Bridge.

July 1, 1894, balance unexpended	$2,489.56
Amount appropriated by act of August 17, 1894	50,000.00
	52,489.56
June 30, 1895, amount expended during fiscal year	20,985.97
July 1, 1895, balance unexpended	31,503.59
July 1, 1895, amount covered by uncompleted contracts	3,770.00
July 1, 1895, balance available	27,733.59
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	25,000.00

(See Appendix S S 1.)

2. Mokelumne River, California.—Before this river was improved navigation on it was difficult and dangerous on account of numerous bad snags and overhanging trees.

The original project, adopted in 1884, had for its object the removal of trees and snags obstructing navigation. In 1892 this was increased to include the removal of a shoal near New Hope Landing.

Up to June 30, 1894, $12,480.70 had been spent on the river, but the results obtained were not permanent. Some trees require recutting, a few snags should be removed, and the point of land opposite New Hope Landing cut off. This latter will be done as soon as permission from the owners of the land can be obtained. The snags and trees will also be removed. Navigation has been in no way interrupted during the year.

No work has been done on this river during the last fiscal year.

July 1, 1894, balance unexpended	$3,019.30
Amount appropriated by act of August 17, 1894	2,500.00
	5,519.30
June 30, 1895, amount expended during fiscal year	43.50
July 1, 1895, balance unexpended	5,475.80

(See Appendix S S 2.)

3. Sacramento and Feather rivers, California.—Before improvement navigation on these rivers was difficult and dangerous on account of numerous snags, shallow bars, and rapids.

In 1874, a project was adopted having for its object the temporary improvement of the low-water channels by removing snags, scraping bars, and building wing dams. Work has been continuous on this project ever since, whenever funds permitted.

In 1892 the project was modified and increased to include the closure of Jacob Slough, the construction of wing dams on the Feather River, and the treatment of the Yuba River near and above Marysville.

The amount expended to June 30, 1894, was $578,314.92, with the result of obtaining a good navigable channel from Red Bluff to Butte City for boats drawing 2.6 feet of water; from that point to Sacramento, 4 feet, and below Sacramento a low-water channel with a least depth

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of 8 feet, except at Heacock Shoals. Jacob Slough had also been closed and a new mouth made for the Yuba River.

During the past fiscal year the snag boat worked in the upper river 102 days, when it returned to Sacramento, after removing 684 snags and constructing 1,055 linear feet of wing dams. At Sacramento a double row of piles had been driven to build a wing dam for the purpose of removing a shoal which had formed in the draw of the Sacramento Bridge. The snag boat was then employed to fill in with brush, weighted with sand bags, between the rows of piles, completing the wing dam. It was then taken to the lower river where 6 snags and 10 leaning trees were removed from near Walnut Grove Ferry. The total cost of this work, including the wing dam at Sacramento Bridge, was $15,982.34. After the snag boat was laid up for the season a contract was made to put a new boiler in the boat.

The wing dams, projected for removing the shoal at Heacock, were built during the fiscal year, under contract. Their effect is not yet apparent, as the river rose just after their completion, and is still at a high stage. The dam built to close Jacob Break received some repairs.

A survey of the Feather River was made, and one of the Sacramento, from the mouth of the Feather down, commenced. The latter was completed as far as Ryde, some 37 miles below Sacramento, when the weather stopped work. Borings were also made in the bed of the Yuba River.

The work done during the year has maintained the Sacramento River in good navigable condition to Red Bluff, the head of navigation. The benefit derived from the wing dams constructed at Heacock can not be ascertained until the river falls.

Owing to the natural disappearance of shoals on the lower river, money appropriated for their removal was not required, and therefore was not expended. The balance available, $146,064.79, will, it is thought, be sufficient to maintain navigation on the Sacramento and Feather rivers until June 30, 1897.

July 1, 1894, balance unexpended	$66,685.08
Amount appropriated by act of August 17, 1894	115,000.00
	181,685.08
June 30, 1895, amount expended during fiscal year	33,426.29
July 1, 1895, balance unexpended	148,258.79
July 1, 1895, amount covered by uncompleted contracts	2,194.00
July 1, 1895, balance available	146,064.79

(See Appendix S S 3.)

4. Petaluma Creek, California.—Before improvement the channel in this creek was very crooked and in places dry at low water, making navigation difficult and uncertain.

In 1880 a project for its improvement was adopted which had for its object to obtain, by dredging, a channel 50 feet wide and 3 feet deep at low water, and straighten it by cut-offs.

Up to June 30, 1894, $45,858.05 had been spent, and the result obtained was a dredged channel reaching the town of Petaluma, 5,973 feet long, 50 feet wide, and 3 to 4 feet deep at low water.

No work has been done during the fiscal year, but the channel, which is not self-maintaining, having shoaled somewhat, bids were on two occasions invited for redredging it. They were, however, rejected on both occasions, and the work will be done with the U. S. dredge in the near future.

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July 1, 1894, balance unexpended	$141.95
Amount appropriated by act of August 17, 1894	15,000.00
	15,141.95
June 30, 1895, amount expended during fiscal year	79.24
July 1, 1895, balance unexpended	15,062.71

(See Appendix S S 4.)

5. Humboldt Harbor and Bay, California.—Before improvement the entrance to the harbor was obstructed by a bar, the channel over which was variable in position from southwest to northwest over a distance of 1½ miles in length between its extreme southerly and northerly positions; it was also variable in width and depth. Inside the entrance were numerous shoals obstructing the channels, so that depths of 7 feet to Eureka and 6 feet to Arcata and Hookton only existed, rendering it difficult for vessels to reach the wharves.

In 1881 a project was adopted with a view of securing, by dredging, a channel 13 feet deep and 200 feet wide to Eureka and one 10 feet deep and 100 feet wide to Arcata and Hookton. This project was completed in 1884 at a cost of $80,884.69. These channels have again filled up and will have to be redredged.

In 1882 a further project was adopted for improving the channel over the bar at the entrance, to fix it in position, and improve its depth. This was to be done by constructing a low-tide jetty running out from the south spit in a northwesterly direction for a distance of 6,000 feet. After commencement of work great erosion of the north spit took place; on this account the project was enlarged to embrace the construction of a jetty on the north spit; this latter was not to be begun until the completion of the south jetty. Both jetties were to be built up to high-tide level and were to extend seaward to the 18-foot contour. A dike about 1,500 feet long had been built in 1891 to check the scour on the north spit. Erosion still continuing, the project was slightly modified in 1892. The modification consisted in relocation of the north jetty so as to make the previously constructed dike a part of the jetty, and in authorizing the building of the north jetty out to a point sufficiently far to arrest the erosion without awaiting the completion of the south jetty.

The amount expended on the projects up to June 30, 1894 was $576,483.59, of which $80,884.69 was expended in dredging and $495,598.90 in jetty work.

The south jetty was then 3,699 feet long and the north jetty 5,178 feet long.

Although the jetties were far from completion there was at this time a channel of 24 feet in depth over the bar opening in a southwesterly direction, and vessels had no difficulty in entering the harbor.

At the commencement of the fiscal year work was in progress on both jetties. On the south jetty the work in the early part of the year consisted of repairing the trestle where destroyed or damaged by storms and revetting the slopes on the channel side with rock to prevent undermining. It had been expected to extend this jetty, but owing to the depth of water (35 to 50 feet) at and beyond its outer end, this plan was abandoned on account of the excessive cost of jetty construction in this depth of water, especially when it was believed that the channel would again shift and shoaling would take place on the prolongation of the jetty line. Accordingly work ceased on this jetty and was not resumed until April, 1895. When work was recommenced it at first consisted of repairs to the trestle, 51 bents of which had been destroyed by storms during the fall and winter.

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By the end of the year the trestle had been rebuilt to bent 230, a length of 3,682 feet. Pile driving and enrockment is now progressing.

Surveys have disclosed the fact that the channel has shifted to the northward and some shoaling has occurred on the prolongation of the line of jetty, thus making extension work possible. This work will be commenced as soon as the trestle repairs are completed.

The work on the north jetty during the year consisted of regular construction, the building of spurs to protect the jetty from being undermined and revetting the channel slopes for the same purpose. During the fiscal year the work on this jetty amounted to 2,898 feet of trestle, 19,715 cubic yards of brush, and 197,216 tons of stone. The jetty at the close of the year is completed for 6,329 feet; trestle is complete to bent 473, a distance of 7,579 feet.

The total delivery of rock on both jetties for the year is 205,676 tons.

July 1, 1894, balance unexpended		$518,016.41
Amount appropriated by sundry civil act approved March 2, 1895		225,000.00
		743,016.41
June 30, 1895, amount expended during fiscal year		300,244.37
July 1, 1895, balance unexpended		442,772.04
July 1, 1895, outstanding liabilities	$50,594.30	
July 1, 1895, amount covered by uncompleted contracts	392,177.74	
		442,772.04

Amount (estimated) required for completion of existing project	818,115.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	475,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix S S 5.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations and surveys of the following localities, required by the act of August 17, 1894, were made by the local engineer, Maj. W. H. Heuer, Corps of Engineers, and reports thereon submitted through the division engineer, Col. G. H. Mendell, Corps of Engineers:

1. Preliminary examination of Feather River, California, above Marysville.—Major Heuer submitted report of examination October 12, 1894. He considers that there is no public necessity for the improvement of the Feather River above Marysville, and his views are concurred in by the division engineer and by this office. The report was transmitted to Congress and printed in House Ex. Doc. No. 53, Fifty-third Congress, third session. (See also Appendix S S 6.)

2. Preliminary examination of Georgiana River, California.—Major Heuer submitted report of examination November 26, 1894. It is his opinion, concurred in by the division engineer and by this office, that this locality is worthy of improvement to the extent of removing snags and overhanging trees which obstruct navigation. No survey of the river is necessary. The report was transmitted to Congress and printed in House Ex. Doc. No. 72, Fifty-third Congress, third session. (See also Appendix S S 7.)

3. Preliminary examination of Mendocino Harbor, California.—Major Heuer, under date of February 28, 1895, submitted report of examination. It is his opinion, concurred in by the division engineer and by this office, that the harbor is not worthy of improvement by the General Government. (See Appendix S S 8.)

4. Preliminary examination of American River, California, with a view to prevention of sand flowing into the Sacramento River, near the

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city of Sacramento.—The report of the results of this examination was submitted by Major Heuer under date of August 12, 1895. It is his opinion, concurred in by the division engineer and by this office, that the river is not worthy of improvement by the General Government. (See Appendix S S 9.)

5. Survey of Old River Branch of San Joaquin River, California.—Major Heuer submitted report of survey January 9, 1895. The project proposed by him contemplates obtaining a depth of 5 feet in a channel 50 feet wide through the shoals between Naglees Ferry and Naglee's warehouse, at an estimated cost of $2,000. The report was transmitted to Congress and printed in House Ex. Doc. No. 225, Fifty-third Congress, third session. (See also Appendix S S 10.)

6. Survey of Crescent City Harbor, California.—Major Heuer submitted report of survey January 9, 1895. He submits a project for the removal of three rocks from this harbor and estimates that the work will cost $285,000. At the same time he states that in his opinion the removal of these rocks, or either of them, is not a public necessity; the expense of removing them would be incommensurate with the advantages to be derived from their removal, and hence with the present amount of commerce the roadstead of Crescent City is not worthy of improvement to the extent of removing these rocks, and his recommendations are concurred in by the division engineer. The report was transmitted to Congress and printed in House Ex. Doc. No. 231, Fifty-third Congress, third session. (See also Appendix S S 11.)

Major Heuer was also charged with the duty of making preliminary examinations of—

1. San Joaquin River, California, above the mouth of Stanislaus River, with a view to improvement, including closure of sloughs to a height sufficient to maintain current in main channel during low-water period.

2. Steamboat Channel, and from junction thereof with Sacramento River to mouth of said river, with a view to improvement, enlargement of navigable channel, and to increase capacity for flood discharge.

The reports of the results of these examinations will be duly submitted when received.

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN OREGON, WASHINGTON, AND IDAHO.

This district was in the charge of Capt. Thomas W. Symons, Corps of Engineers, having under his immediate orders Lieut. F. R. Shunk, Corps of Engineers; Division Engineer, Col. G. H. Mendell, Corps of Engineers.

1. Coquille River, Oregon (general improvement).—Before improvement the entrance to the Coquille River was considered very dangerous. The channel was unusually long, tortuous, and narrow, skirting the south headland and studded with rocks from the bar to a distance of one-half mile inside. Its depth was only about 3 feet at low water. It was, however, constantly shifting and at long intervals would break through the north spit and run out to sea just south of Rackliffe Rock. At such times the channel was at its best and the entrance was comparatively safe; but this condition never lasted long. The mean range of tide is 4.1 feet.

The first plan of improvement was to construct two parallel high-tide jetties, 800 feet apart, running out to sea a sufficient distance to scour and maintain a channel with a least depth of 8 feet over the bar at low water, the north jetty to start from Rackliffe Rock and the south jetty from a point inside the entrance. In 1891 the project was changed to

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provide for an entrance width of 600 feet instead of 800 feet. The estimated cost was $164,200. In 1892, when $105,000 had been expended, the cost of completing the project was reestimated at $180,000, making a total estimated cost of $285,000.

The amount expended prior to June 30, 1894, was $127,934.08, including $6,883.90 expended for snagging on the upper river.

As a result the entrance was for considerable periods kept straight, with a depth of 8 to 10 feet at low water. At other times winds and tides would heap sand into the channel, causing the waters to spread out and shoal or to form a new channel, shallow and unfavorably directed to the northward.

The amount expended during the fiscal year ending June 30, 1895, was $3,537.33.

A contract for repairing and extending the south jetty was let in April. The contractors at the close of the year were engaged in preparatory work at the quarry and on repairs of connecting tramway.

The conditions of the channel across the bar during the year were more stable than they had been before.

The appropriations amount to $150,000.

July 1, 1894, balance unexpended		$2,065.92
Amount appropriated by act of August 17, 1894		20,000.00
		22,065.92
June 30, 1895, amount expended during fiscal year		3,537.33
July 1, 1895, balance unexpended		18,528.59
July 1, 1895, outstanding liabilities	$150.00	
July 1, 1895, amount covered by uncompleted contracts	7,439.75	
		7,589.75
July 1, 1895, balance available		10,938.84

Amount (estimated) required for completion of existing project	135,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix T T 1.)

2. Coquille River, Oregon, between Coquille City and Myrtle Point.—The Coquille is one of the principal streams of southern Oregon. It is navigated by coasting vessels from its mouth to Coquille City, a distance of 25 miles. This portion of the river at times has been more or less obstructed by snags, but no serious shoals have formed.

Above Coquille City river steamers ply as far as Myrtle Point, a distance of 12 miles. It has always been difficult to keep this portion of the river open. The drainage area is densely wooded, and every freshet brings down many stumps, logs, and trees; these lodge and arrest sediment, forming shoals.

The plan of improvement is to remove all objectionable snags, and to contract the river at certain shoals to a width of 50 feet, in order that the shoals may scour away. The estimated cost was $26,000.

Until the fiscal year ending June 30, 1893, this work was done with certain sums diverted from the appropriations for the mouth of the river. A total of $6,883.90 was so expended. The act of July 13, 1892, made a separate appropriation for the upper river. From this date to June 30, 1894, the amount expended was $5,000. A great many snags were removed, but while this was of benefit to navigation, the river has filled up to a considerable extent with alluvium, so that its navigable capacity was not increased.

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The amount of money expended during the year ending June 30, 1895, was $2,804.29.

During the year 375 snags were removed, 300 feet of new wing dam was built, and an extension made to a wing dam previously constructed.

A survey of the river from Coquille City to Myrtle Point has been made, and from the information thus obtained a revised project and estimate of cost of improvement has been submitted and approved March 14, 1895.

This estimate amounts to $43,176.48.

The appropriations amount to $10,000.

Amount appropriated by act of August 17, 1894	$5,000.00
June 30, 1895, amount expended during fiscal year	2,804.29
July 1, 1895, balance unexpended	2,195.71
Amount (estimated) required for completion of existing project	40,980.77
Amount that can be profitably expended in fiscal year ending June 30, 1897	5,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix T T 2.)

3. Entrance to Coos Bay and Harbor, Oregon.—Before improvement the obstructions at the entrance to this harbor were, first, the sandy shifting outer bar, and second, the inner sandy shoals accumulated by the northwest winds of spring, summer, and autumn.

The winds also caused the north spit to extend southward, greatly contracting the navigable channel and making the outer channel follow the west side of the spit in a long and tortuous course across the bar. The channel would at times break through the north spit on a line whose general direction is from Fossil Point to a point just north of Coos Head. It was then direct, its depth greatest, and vessels could pass without trouble. The mean range of the tide was 5.6 feet.

A project was adopted in 1879 to build, at an estimated cost of $600,000, such a stone and wood jetty as might be found best from a point 250 yards below the northern extremity of Fossil Point on a line toward the east end of Coos Head, curving at its outer end so as to be directed a little north of the head. The object was to prevent the extension of the north spit and to open and maintain a deeper and more direct channel across the bar. This project has been abandoned.

The present project is to build two high-tide stone jetties, one from Coos Head and one from the south end of the north spit, extending out toward the bar and leaving an entrance about 1,500 feet wide. The project also includes the protection of the north spit by plantations to prevent sand from blowing into the harbor. The estimated cost is $2,466,412.20.

The amount expended prior to June 30, 1894, was $213,750 on the old project and $327,044.13 on the new, a total of $540,794.13.

The north jetty tramway had been built to a total length of 9,520 feet. A vast amount of sand had been impounded and a minimum depth of 20 feet at low water maintained over the bar.

The amount expended during the year ending June 30, 1895, was $98,593.16.

The north jetty tramway was built during the year to the full length contemplated in the project, 10,368 feet, and its enrockment well advanced. A bar depth of from 18 to 21 feet at low water has been continuously maintained during the year.

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July 1, 1894, balance unexpended	$7,955.87
Amount appropriated by act of August 17, 1894	95,000.00
	102,955.87
June 30, 1895, amount expended during fiscal year	98,593.16
July 1, 1895, balance unexpended	4,362.71
July 1, 1895, outstanding liabilities	475.00
July 1, 1895, balance available	3,887.71

Amount (estimated) required for completion of existing project..... 2,036,412.20
Amount that can be profitably expended in fiscal year ending June 30, 1897..... 95,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix T T 3.)

4. Harbor at Coos Bay, Oregon (dredging).—This is a new work, the first appropriation for it having been made in the river and harbor act of August 17, 1894. The improvement contemplates the removal of shoals in the upper part of the bay, and its tributary sloughs, which interfere with navigation. This includes the construction of a dredger and two hopper scows for use on the work. The original estimated cost of the project, based on a survey made in 1891, was $27,390.

Since the preparation of the original project the conditions have so materially changed at Coos Bay as to render the project insufficient and unsuitable. The depth of channel through the bar at the entrance is greater than had been expected, the ruling depth being now from 18 to 20 feet. The shoals covered by the original project have changed and others have formed. The depth of 10 feet through these shoals aimed at by the project appears to be under existing conditions insufficient. The project and estimate heretofore submitted are inadequate to the changed conditions, and a new survey, project, and estimate will be required.

Plans, specifications, and proposal for the construction of the dredging machinery were solicited by public advertisement; bids were all rejected, owing to the insufficiency of the available balance to construct a dredge and auxiliary plant suitable for the work.

The amount expended during the fiscal year was $47.10.

The appropriations amount to $13,000.

Amount appropriated by act of August 17, 1894	$13,000.00
June 30, 1895, amount expended during fiscal year	47.10
July 1, 1895, balance unexpended	12,952.90

Amount (estimated) required for completion of existing project..... 14,390.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.

(See Appendix T T 4.)

5. Umpqua River, Oregon.—Just below Scottsburg, the head of navigation on the Umpqua River, there are five sandstone ledges 12 to 15 feet wide, and from 1 to 2 feet below low tide, at a low-river stage. They are separated by pools about 150 feet wide and 5 to 10 feet deep at low water. The first plan of improvement submitted and approved in 1885 was to blast out a channel 50 feet wide and 3 feet deep through these ledges. The estimated cost was $4,056. The Secretary of War authorized the expenditure of $4,685.89, the balance unexpended of the appropriation of March 3, 1871, for improving the Umpqua River under a previous project, which had been abandoned.

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In 1889, after a further appropriation of $2,000 had been made, the project was revised so as to provide a depth of 4 feet, and the amount required for its completion estimated to be $9,000, in addition to the balance then available. It was subsequently found that this estimate was insufficient, and the cost of the project was estimated at $6,000 additional, making a total estimated cost of the work $21,685.89.

The amount expended on this project prior to June 30, 1894, was $15,475.58.

A large amount of rock has been removed, but the appropriation being exhausted, the channel has been left in such a condition that the work done can be of little benefit until the entire project is completed.

About 500 cubic yards of rock remains to be excavated to complete the existing project.

The amount expended during the year ending June 30, 1895, was $122.50.

The appropriations amount to $33,500, of which $17,814.11 was expended on the abandoned project, leaving $15,685.89 applicable to the existing project.

July 1, 1894, balance unexpended	$210.31
June 30, 1895, amount expended during fiscal year	122.50
July 1, 1895, balance unexpended	87.81
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	6,000.00

(See Appendix T T 5.)

6. Mouth of Siuslaw River, Oregon.—The Siuslaw River enters the ocean in the midst of a vast, shifting, sandy beach, without any headland or fixed point to determine the location of the entrance channel. The unconfined channel has a range of about 1 mile over which it wanders. The depth on the bar varies from 5 to 12 feet at low water, and the bar channel is very variable in position and direction. At times a channel running nearly parallel with the coast is developed inside the bar. This channel is narrow, ill-defined, and dangerous, as boats have to pass through it in the trough of the sea. At other times there are two channels.

The plan of improvement is to confine the waters between high-tide brush and stone jetties, so located as to direct the currents upon the bar in a direction practically perpendicular to the coast. The north jetty will be 4,500 feet long, the south jetty 3,200 feet long, and they are to converge to an entrance 600 feet wide at the crest of the bar. The estimated cost is $700,000.

The amount expended prior to June 30, 1894, was $68,651.08. The tramway was built to a length of 3,029 feet and partially enrocked, but the work had not progressed sufficiently to produce any results of importance.

At the close of this period the tramway and wharf had been badly damaged by storms and landslides.

The amount expended during the year ending June 30, 1895, was $2,609.52.

A contract was made for the repair and extension of the jetty tramway, the placing of brush mattresses, and the enrockment of the jetty. At the close of the year the contractor had but fairly commenced operations under his contract and no material benefits had resulted.

The appropriations amount to $95,000.

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July 1, 1894, balance unexpended		$1,348.92
Amount appropriated by act of August 17, 1894		25,000.00
		26,348.92
June 30, 1895, amount expended during fiscal year		2,609.52
July 1, 1895, balance unexpended		23,739.40
July 1, 1895, outstanding liabilities	$350.00	
July 1, 1895, amount covered by uncompleted contracts	11,252.50	
		11,602.50
July 1, 1895, balance available		12,136.90

Amount (estimated) required for completion of existing project	605,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix T T 6.)

7. Yaquina Bay, Oregon.—Before improvement the usual low-water depths over the bar at Yaquina Bay were from 7 to 8 feet. There were three distinct channels, known as the North, Middle, and South channels. The South Channel was the one mostly used, but was rendered dangerous by rocks. The Middle Channel, though free from rocks, was little used, being usually the shoalest. The North Channel, besides being long and tortuous, was so studded with rocks as to be considered unnavigable. These channels were constantly shifting and changing in depth.

A project was adopted in 1881 to construct a stone jetty on the south side, at an estimated cost of $465,000, in order to cause the South Channel to shoal up, and to obtain a least high-water depth of 17 feet in the Middle Channel. The jetty was to be 2 feet above mean low water, and was to run out to sea a distance of 2,500 feet from low-water line. The stone was to be deposited from barges, and cribs were to be used if possible. Both were found impossible, owing to rough water, and the jetty had to be built from a tramway begun at the high-tide line, making the projected length about 4,000 feet.

The present project, adopted in 1888, is to raise the south jetty to high-tide level without farther extension, and to build a mid-tide jetty on the north side about 2,300 feet long from the North Head to a point opposite the end of the south jetty and about 1,000 feet from it. This project has been modified to provide for raising the north jetty to high-tide level, and for building five groins from the south jetty toward the channel. The estimated cost from the beginning is $755,560.30.

The amount expended prior to June 30, 1894, was $626,093.34.

Both jetties had been built to their full length, but not to the full height projected. An inner bar had formed inside the entrance, had disappeared later, and was re-forming. It had not, however, become an obstruction, but threatened to do so.

The amount expended during the year ending June 30, 1895, was $37,054.40. The enrockment of the north jetty was continued, and the south-jetty trestle repaired. Two groins connected with the south jetty were extended and partly enrocked, with a view of checking the formation of the inner bar, and are believed to be effective.

A Board of Engineers was appointed to consider the subject of the further improvement, and at the close of the year a survey, to obtain a full knowledge of existing conditions, was in progress.

It is estimated that with the balance available the south jetty and groins will be fully completed, and that for the completion of the north jetty $25,000 will be required.

The work has developed a permanent channel of 12 to 15 feet depth through the bar, where, before there existed an uncertain and shift-

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ing channel 6 to 7 feet deep. The effects contemplated in the original project have been attained, and the additional work remaining to be done is required to insure permanence to the work.

The appropriations amount to $685,000.

July 1, 1894, balance unexpended		$8,906.66
Amount appropriated by act of August 17, 1894		50,000.00
		58,906.66
June 30, 1895, amount expended during fiscal year		37,054.40
July 1, 1895, balance unexpended		21,852.26
July 1, 1895, outstanding liabilities	$1,000.00	
July 1, 1895, amount covered by uncompleted contracts	8,500.00	
		9,500.00
July 1, 1895, balance available		12,352.26
Amount (estimated) required for completion of existing project		25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix T T 7.)

8. *Tillamook Bay and Bar, Oregon.*—Tillamook Bay is 50 miles south of the Columbia River. Its tidal area is 13.5 square miles, the mean range of the tide being 6.5 feet. The channel over the bar is one of the safest on the coast, as it is direct and shifts but little.

The bay at low tide is reduced to three channels, running through sand and mud flats. The depth of water in these channels is fair at the entrance, but decreases to 1 or 2 feet at the head of the bay.

Tillamook City, the chief town on the bay, is situated on Hoquarton Slough, a tidal inlet reached by the middle channel. The other places of importance are on the north channel. The only connection between these two channels is near the mouth of the bay.

The plan of improvement is to make a navigable pass between the north and middle channels, to deflect the waters of the south into the middle channel by building a dike at Junction Bar, and to close one of the two channels at Dry Stocking Bar in Hoquarton Slough.

The estimated cost is $100,000.

The amount expended prior to June 30, 1894, was $16,696.90. Of this amount $5,700 was expended upon an obsolete project, and $10,996.90 under the existing project, resulting in the construction of 2,100 linear feet of dike at Dry Stocking Bar and Junction Bar dikes.

The amount expended during the year ending June 30, 1895, was $2,593.99. A contract was let for continuing the dike construction, and work under this contract was fairly under way at the close of the fiscal year.

July 1, 1894, balance unexpended		$4,003.10
Amount appropriated by act of August 17, 1894		16,000.00
		20,003.10
June 30, 1895, amount expended during fiscal year		2,593.99
July 1, 1895, balance unexpended		17,409.11
July 1, 1895, outstanding liabilities	$150.00	
July 1, 1895, amount covered by uncompleted contracts	12,225.67	
		12,375.67
July 1, 1895, balance available		5,033.44
Amount (estimated) required for completion of existing project		69,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		15,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix T T 8.)

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9. Entrance to Nehalem Bay, Oregon.—Nehalem Bay at high water is about 2 miles long by 1½ miles wide at the widest part, and is connected with the ocean by a narrow channel extending in a southerly direction about 3 miles. This channel varies in width from 1,000 to 2,000 feet at high tide. It is separated from the ocean by a low sandy peninsula about 2½ miles long and one-fourth mile wide. The entrance channel south of this peninsula is shifting, its northern and southern limits being about 1 mile apart. The channel across the bar at the entrance is ordinarily 5 to 6 feet deep at low tide.

The plan of improvement is to hold the channel in its southern position by building two high-tide stone jetties, the northern starting from the above-mentioned peninsula and the southern from the mainland; these to converge to an entrance width of about 500 feet, and then, if necessary, to run parallel for a sufficient distance to secure a bar depth of 8 feet at low water. The estimated cost is $712,338.

The amount expended prior to June 30, 1894, was $415.08. No work was done beyond making a survey.

There was no expenditure during the year ending June 30, 1895, and no results were obtained.

The appropriation (1890) is $10,000.

July 1, 1894, balance unexpended	$9,584.92
July 1, 1895, balance unexpended	9,584.92

(See Appendix T T 9.)

10. Upper Snake River, Idaho, between Huntington Bridge and Seven Devils mining district.—This portion of the Snake River flows through a deep canyon, and is swift, with many rapids and dangerous rocks. The bed and banks are hard basalt and granite. Navigation is almost impossible.

The plan of improvement is to remove rocks and reefs from a channel 150 feet wide, and to put in ringbolts and iron posts to assist boats in lining up. The estimated cost is $80,000.

The amount expended prior to June 30, 1894, was $19,251.12. A large amount of rock was removed from the channel through the rapids to a point 3 miles below Huntington Bridge.

The amount expended during the fiscal year ending June 30, 1895, was $13,696.31. Work of rock removal was prosecuted during four and a half months of the winter of 1894 and 1895, and the improvement of the channel extended 2½ miles farther downstream

The appropriations amount to $45,000.

July 1, 1894, balance unexpended	$748.88
Amount appropriated by act of August 17, 1894	25,000.00
	25,748.88
June 30, 1895, amount expended during fiscal year	13,696.31
July 1, 1895, balance unexpended	12,052.57
July 1, 1895, outstanding liabilities	25.00
July 1, 1895, balance available	12,027.57
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	35,000.00

(See Appendix T T 10.)

11. Upper Columbia and Snake rivers, Oregon and Washington.—Under the above head are included the continuous Columbia and Snak rivers from Celilo, at the head of The Dalles, to Asotin, Wash. The Upper Columbia and Snake form a continuous line of river which is navigable,

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but broken by many rapids which render navigation difficult and dangerous. These rapids are in nearly every instance caused by rocky bars, with occasional bowlders. The channels before improvement were crooked and narrow, the ruling depth at low water over many of the bars was 2 to 3 feet, and some were practically impassable at low water. The Columbia was navigable all the year unless closed by ice. The Snake, however, was navigable only during high water, for two or three months in the spring.

Before 1877 $120,000 had been appropriated for the work of improvement, and had been expended in surveys, and in rock removal at the principal rapids. In 1877 a project was approved which provided for the removal of bowlders and reefs, and for scraping gravel bars in the rivers as far as Lewiston. The estimated cost was $132,000.

In 1892 the upper limit of the work was extended 7 miles to Asotin, Wash.

The construction of railway lines paralleling the river caused the navigation of these two rivers between Riparia and Celilo to be abandoned before 1882. Improvements on that reach were consequently discontinued, and the subsequent works confined to the upper reach between Riparia and Asotin.

The present plan of improvement is to remove bowlders, gravel bars, and rock ledges from the upper reach, and put in such contraction works as may be necessary.

The estimated cost of the work has not been accurately determined, because of the lack of continuous and full surveys, and because many of the obstructions which it is necessary to remove are continually recurring.

The amount expended on the present project prior to June 30, 1894, was $165,554.52.

The worst rocks and reefs between Riparia and Asotin were removed, with great benefit to navigation. At two of the worst bars dikes were built, which have considerably improved the channel.

The amount expended during the year ending June 30, 1895, was $841.47. The results are about as before.

The appropriations amount to $276,000.

July 1, 1894, balance unexpended	$445.48
Amount appropriated by act of August 17, 1894	5,000.00
	5,445.48
June 30, 1895, amount expended during fiscal year	841.47
July 1, 1895, balance unexpended	4,604.01
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	5,000.00

(See Appendix T T 11.)

12. Columbia River between head of Rock Island Rapids and foot of Priest Rapids, Washington.—This portion of the Columbia River is about 60 miles long. The banks are precipitous bluffs, from 1,000 to 3,000 feet high. The neighboring country is rocky and sterile. Navigation is obstructed by Rock Island, Cabinet and Priest rapids.

At Rock Island Rapids the river is divided by a large rocky island. The channel is obstructed by reefs, rocks, sharply projecting points, and extensive gravel deposits, which dam up the water to such an extent that its slope in escaping is very steep. The river here, at a stage 4 feet above low water, has a fall of 10 feet in 3,000 feet, and 12½ feet in 8,000 feet.

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At Cabinet Rapids a mass of basalt projecting from the left bank causes the current to impinge upon the nearly vertical rocks of the right bank; the channel is also obstructed by masses of rock. The fall here is 10 feet in 8,000 feet.

Priest Rapids include seven principal rapids in about 10 miles. The total fall in this distance is 72 feet at low water and 63½ feet at high water. At all these rapids the banks and bottom are of hard and jagged basalt.

The plan of improvement is to remove rocks at the three rapids, and put in iron posts and ringbolts to enable steamers to line up. The cost of this work was estimated at $550,000, but subsequent study and consideration make it practically certain that neither this nor any other sum in reason will be sufficient to attain the object aimed at. In addition, the project included a survey from Rock Island Rapids to the Canadian boundary.

The amount expended on the river prior to June 30, 1894, was $51,989.39; on the survey, $10,000.

The survey was completed from the Canadian boundary to the mouth of the Okanogan. The worst obstructions were removed from the channel at the three rapids, and a number of posts and ringbolts put in. The results would have rendered navigation safer had there been any navigation.

The amount expended during the year ending June 30, 1895, was $5,385.31. Of this amount $5,379.90 was expended on the improvement of the Columbia River from Rock Island Rapids to Foster Creek Rapids, Washington, as authorized by the river and harbor act of August 17, 1894. The remainder was expended prior to the passage of that act in connection with office expenses and care of property.

No work was done under the project and no further results were obtained. As the act above referred to diverts the remainder of the funds available for the work to improving the reach of river from Rock Island Rapids to Foster Creek Rapids, it is considered that the project for the improvement between the head of Rock Island Rapids and the foot of Priest Rapids, is abandoned.

July 1, 1894, balance unexpended	$8,010.61
June 30, 1895, amount expended during fiscal year	5,385.31
July 1, 1895, balance unexpended	2,625.30

(See Appendix T T 12.)

13. Columbia River from Rock Island Rapids to Foster Creek Rapids, Washington.—This is a new work, and is provided for by the river and harbor act of August 17, 1894, in which authority is granted for the expenditure on this work of the unexpended balance of appropriations for the Columbia River between the head of Rock Island Rapids and the foot of Priest Rapids.

The work consisted in rock removal from Rocky Reach and from Methow Rapids, at both places the navigation being very much benefited.

The amount of rock removal during the season is estimated at 4,055 cubic yards.

The amount available for this work was $8,005.20.

Of this amount there was expended $5,379.90, leaving a balance of $2,625.30 available for future operations.

The unexpended balance of the appropriation for the improvement of the Columbia River, between the head of Rock Island Rapids and the foot of Priest Rapids, made available for the work by the river and

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harbor act of August 17, 1894, was $8,005.20. Of this amount $5,379.90 has been expended, leaving a balance available of $2,625.30.

(See Appendix T T 13.)

14. Willapa River and Harbor, Washington.—Willapa Harbor, formerly known as Shoalwater Bay, connects with the Pacific Ocean 28 miles to the north of the entrance to the Columbia River. The only portion of the harbor to which any consideration in the way of improvement has been given is that in the vicinity of South Bend, the principal city of the harbor and the terminus of the railroad from the main line of the Northern Pacific at Chehalis.

South Bend is situated near the mouth of the Willapa River. Just at the upper limits of the town the river divides itself into a main channel and a secondary channel, the latter known as Mailboat Slough. This division of the waters caused bars to form in the main channel at both the upper and lower ends of the slough. There were also several bars in the river proper between South Bend and Willapa City.

The plan of improvement adopted consists in building a dike of piles, brush, and stone across the head of Mailboat Slough, in order to concentrate the ebbing and flooding currents into the main channel, and thereby produce as great a scour as possible on the shoals at the head and foot of the slough; also to dredge a channel 100 feet wide and 8 feet deep, at low water, through the reef, just below Willapa City, and to close Louderback Slough with a pile, brush, and stone dike, with the object of compelling the currents to scour a channel through the bar into the river at its lower end. The estimated cost of the work is $31,350, which has all been appropriated.

The act of August 17, 1894, appropriated $13,350, and left it discretionary with the Secretary of War to expend of this amount $2,500 for the removal of obstructions in the North River.

The amount expended to June 30, 1894, was $17,501.38, of which $6,318.73 was expended in building the Mailboat Slough dikes and $11,182.65 in the work of excavating the shoal bar below Willapa City.

The amount of money expended during the fiscal year ending June 30, 1895, was $3,168.56. Of this amount, $3,081.51 was expended in improving Willapa River and Harbor and $87.05 on the improvement of the North River.

The dike work in the harbor and river was completed, and the work of dredging through the shoal just below Willapa City was in progress at the close of the fiscal year.

The work of removing the log jam in the North River is practically completed.

The money appropriated will fully complete the work called for by the project and make the requisite channel through the North River obstructions.

Such being the case, no further estimate is submitted.

July 1, 1894, balance unexpended		$498.62
Amount appropriated by act of August 17, 1894		13,350.00
		13,848.62
June 30, 1895, amount expended during fiscal year		3,168.56
July 1, 1895, balance unexpended		10,680.06
July 1, 1895, outstanding liabilities	$1,000.00	
July 1, 1895, amount covered by uncompleted contracts	2,175.00	
		3,175.00
July 1, 1895, balance available		7,505.06

(See Appendix T T 14.)

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15. Grays Harbor and Chehalis River, Washington.—The Chehalis River is the chief tributary of Grays Harbor. From Montesano to the bay there is usually enough water for coasting vessels, but there are four obstructive shoals. At the head of Grays Harbor the waters divide into a north and south channel. There is also a middle channel connecting these two. These divisions cause objectionable shoals.

The plan of improvement is to remove the shoals from the river by dredging and closing side sloughs, so as to give a depth of 16 feet at half tide, and to build pile, brush, and stone dikes in the harbor, wholly closing the middle channel, and closing the south channel with the exception of a gap 1,000 feet wide and about 8 feet deep, with a view to increasing the tidal flow through the north channel and scouring away the bars.

The estimated cost is $150,000.

The amount expended prior to June 30, 1894, was $49,574.91.

The dike closing the south channel had been completed and that closing the middle channel well advanced. The result has been a great improvement in the north channel, there being an increase of 2 feet in depth over the worst shoal.

The amount expended during the year ending June 30, 1895, was $16,217.88. The depths on the bar in the north channel at the head of the bay continued to increase until the softer superincumbent material had been removed. A greater depth it is judged can be maintained after the removal of the less yielding material. The effect of the dikes constructed in the Chehalis River is not yet apparent.

The work of dike construction in the bay and river as embodied in the project has been nearly completed. The dredging remains to be done. Since the project was formulated a branch line of the Northern Pacific Railroad has paralleled the river and bay, and materially decreased the navigable importance of the river, and it is consequently questionable whether there is at the present time any necessity to open the river as far up as Montesano for coasting vessels.

The estimate of the amount which can be profitably expended during the next fiscal year is therefore omitted.

The appropriations amount to $75,000.

July 1, 1894, balance unexpended	$425.09
Amount appropriated by act of August 17, 1894	25,000.00
	25,425.09
June 30, 1895, amount expended during fiscal year	16,217.88
July 1, 1895, balance unexpended	9,207.21
July 1, 1895, amount covered by uncompleted contracts	4,500.00
July 1, 1895, balance available	4,707.21
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	75,000.00

(See Appendix T T 15.)

16. Chehalis River, Washington.—The possible navigable portion of the Chehalis River is from Claquato to the mouth, a distance of 90 miles. This may well be considered in three sections.

1. The tidal section from the mouth to Montesano, a distance of 15 miles. In this portion there is a depth of 18 feet at high tide. This portion is navigable for coasting vessels.

2. From Montesano to Elma, 16 miles, the river is slightly affected by the tides, and for the most part has water enough for light-draft boats,

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but it is obstructed by snags and fallen trees, and in summer there is a scarcity of water on the bars.

3. Above Elma the river is practically closed by snags and a general lack of water; it is a succession of pools and shoals. On many of the latter the depth is from 6 to 12 inches only.

The plan of improvement is to remove snags, overhanging trees, drift heaps, shoals, and other obstructions to navigation which may from time to time be found in the portion of the river regularly used by boats. The cost of this work is indefinite.

The amount expended prior to June 30, 1894, was $12,503.16. As a result the river from Montesano to the mouth was kept in a navigable condition.

The amount expended during the year ending June 30, 1895, was $496.84. The river from Montesano to the mouth was cleared of troublesome snags.

The appropriations amount to $13,000.

July 1, 1894, balance unexpended	$496.84
June 30, 1895, amount expended during fiscal year	496.84

(See Appendix T T 16.)

17. Harbor at Olympia, Wash.—Olympia is situated at the head of Budd Inlet, which was badly shoaled up for a distance 8,750 feet from the city. Vessels could reach the city at high tide only. To avoid this inconvenience long wharves had been built, whose maintenance was very expensive on account of the ravages of the teredo.

The plan of improvement is to dredge a channel 250 feet wide and 12 feet deep at mean lower low water from the heart of the city at Fourth Street Bridge to deep water in Budd Inlet. The estimated cost is $275,000.

The amount expended prior to June 30, 1894, was $34,982.73. At the close of that year there was a 6-foot channel extending from Fourth Street Bridge 7,645 feet to deep water, with a width of 90 feet through the Capitol waterway, and from 105 to 125 feet for the remainder of the distance.

The amount expended during the year ending June 30, 1895, was $38,953.64. During the year the channel was enlarged to 200 feet in width, with a depth of 6 feet at low water for the entire distance between deep water and the Capitol waterway. Also a basin averaging 800 feet long and 450 feet wide was dredged.

The appropriations amount to $75,000.

July 1, 1894, balance unexpended	$17.27
Amount appropriated by act of August 17, 1894	40,000.00
	40,017.27
June 30, 1895, amount expended during fiscal year	38,953.64
July 1, 1895, balance unexpended	1,063.63

Amount (estimated) required for completion of existing project	200,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	40,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix T T 17.)

18. Waterway connecting Puget Sound with Lakes Union and Washington.—This is a new work, and contemplates the construction of a ship canal over a part of the route selected and surveyed under authority of the river and harbor act of September 19, 1890, by a Board of Engineers duly appointed. The part of the canal designed to be con-

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structed will connect deep water of Puget Sound with Lake Washington, passing through Salmon Bay and Lake Union en route. The length of the route is 7.86 miles, of which 1.52 miles passing through Lake Union requires dredging, but no construction work, leaving 6.34 miles of waterway to be constructed. The plan provides for dredging through the flats in Shilshole Bay and Salmon Bay, and through the shoals at the head and foot of Lake Union and in Union Bay, an arm of Lake Washington, and for cutting canals between the head of Salmon Bay and Lake Union and between Lake Union and Union Bay. A lock placed at the outlet of Salmon Bay will maintain the surface of the water of Salmon Bay to the level of that of Lake Union. A lock between Lake Union and Union Bay will provide for the difference of level between Lakes Union and Washington. No definite selection of the route to be adopted has yet been made by Congress. By the river and harbor act of August 17, 1894, $25,000 was appropriated for this improvement. This act, however, provided that no part of the appropriation should be expended until the entire right of way and a release from all liability to adjacent property owners had been secured to the United States free of cost and to the satisfaction of the Secretary of War.

In the sundry civil act approved March 2, 1895, authority is given to expend from the appropriation of $25,000 the sum of $5,000 in making a definite survey and location and in preparing the papers necessary to secure the right of way to the United States. This work was commenced on March 15, 1895, and at the close of the fiscal year was still in progress.

The amount expended during the year ending June 30, 1895, was $2,681.06.

The appropriation amounts to $25,000.

Amount appropriated by act of August 17, 1894	$25,000.00
June 30, 1895, amount expended during fiscal year	2,681.06
July 1, 1895, balance unexpended	22,318.94
July 1, 1895, outstanding liabilities	800.00
July 1, 1895, balance available	21,518.94

(See Appendix T T 18.)

19. Everett Harbor, Washington.—This is a new work, the first appropriation for it having been made in the river and harbor act of August 17, 1894.

Everett is situated on a peninsula, one side and the end of which is bounded by the Snohomish River and the other side by the waters of Puget Sound. Of the water front on Puget Sound but a small part has deep water; the remainder fronts on the tide flats which have been formed by the Snohomish River.

A portion of the river, forming the rear or fresh-water boundary of the peninsula, has navigable depths sufficient for all ordinary purposes of commerce, but below this, and especially across the tide flats at the mouth, the water is shallow and great difficulty is experienced in getting into the fresh-water river harbor back of the city.

The plan of improvement adopted for this work provides for a harbor basin in front of the Everett peninsula 200 feet wide, 5,300 feet long, and 26 feet deep at mean lower low water, and a navigable and inlet channel 100 feet wide and 6 feet deep at mean lower low water from the end of the basin around the peninsula to the head of Old River, the material excavated in making the basin and channel to be deposited behind a dike or

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bulkhead of piles and brush, built from the lower end of Smiths Island to the south end of the basin and upon high land and behind existing dikes along the other portion of the channel and Old River. The estimated cost of the work is $372,000.

The amount expended on the project to June 30, 1895, was $84.79.

The work having but fairly commenced no results of value can yet be claimed.

The appropriation amounts to $10,000.

Amount appropriated by act of August 17, 1894		$10,000.00
June 30, 1895, amount expended during fiscal year		84.79
July 1, 1895, balance unexpended		9,915.21
July 1, 1895, outstanding liabilities	$100.00	
July 1, 1895, amount covered by uncompleted contracts	3,670.00	
		3,770.00
July 1, 1895, balance available		6,145 21
Amount (estimated) required for completion of existing project		362,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		10,000.00

(See Appendix T T 19.)

20. Swinomish Slough, Washington.—This is a tidal slough connecting Saratoga Passage and Skagit Bay on the south with Padilla Bay on the north. It is an important highway for the smaller class of steamboats. In some parts, however, it is shallow and crooked, and the approaches to it are across shallow flats.

The plan of improvement is to dredge a channel 100 feet wide and 4 feet deep from deep water in Saratoga Passage across the Skagit Flats, through the shoals of the slough proper, and across the flats in Padilla Bay to deep water, and to build dikes in Skagit and Padilla bays to direct the ebbing and flooding waters through the dredged channels.

The estimated cost is $122,000.

The amount expended prior to June 30, 1894, was $23,774.55.

A wattled pile dike 6,180 feet long was built and a channel 6,120 feet long of the specified dimensions was dredged, connecting the southern end of the slough with deep water in Saratoga Passage.

The amount expended during the year ending June 30, 1895, was $20,486.02.

As an additional result there is a channel dredged through Swinomish Slough proper, so that at all points between the upper end of the slough and La Conner there is a waterway at least 100 feet wide and 4 feet deep at low water.

The appropriations amount to $50,000.

July 1, 1894, balance unexpended		$1,225.45
Amount appropriated by act of August 17, 1894		25,000.00
		26,225.45
June 30, 1895, amount expended during fiscal year		20,486.02
July 1, 1895, balance unexpended		5,739.43
Amount (estimated) required for completion of existing project		72,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		25,000.00

(See Appendix T T 20.)

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21. Puget Sound and its tributary waters, Washington.—This work was formerly known as the "improvement of Skagit, Stillaguamish, Nooksack, Snohomish, and Snoqualmie rivers, Washington."

These rivers, in their original condition, had enough water for steamer navigation, and were the chief highways of the country, but were obstructed by snags, fallen trees, and log jams. About their mouths were large areas of shallow water with tortuous channels, often obstructed by drift.

The plan of improvement is to remove snags, logs, fallen trees, and other obstructions to navigation. For this purpose a snag boat with complete outfit has been provided, which goes from one river to another as necessity requires. The cost of this work is indefinite.

The amount expended prior to June 30, 1894, was $82,048.18. No permanent results were aimed at or obtained. The constantly recurring obstructions require to be periodically removed. The rivers were kept open and navigation rendered much safer.

The amount expended during the year ending June 30, 1895, was $5,775.28.

A great number of obstructions were removed and navigation thereby greatly benefited.

The appropriations amount to $98,500.

July 1, 1894, balance unexpended	$2,451.82
Amount appropriated by act of August 17, 1894	14,000.00
	16,451.82
June 30, 1895, amount expended during fiscal year	5,775.28
July 1, 1895, balance unexpended	10,676.54
July 1, 1895, outstanding liabilities	160.00
July 1, 1895, balance available	10,516.54
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	15,000.00

(See Appendix T T 21.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations and surveys of the following localities, required by the act of August 17, 1894, were made by the local engineer, Capt. T. W. Symons, Corps of Engineers, and reports thereon submitted through the division engineer, Col. G. H. Mendell, Corps of Engineers:

1. Preliminary examination of Umpqua River, Oregon, from Scottsburg to Elkton Rapids.—Captain Symons submitted report of examination January 1, 1895. In his opinion, concurred in by the division engineer and by this office, the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 229, Fifty-third Congress, third session. (See also Appendix T T 22.)

2. Preliminary examination of Yaquina Bay, Oregon, for increased depth.—Captain Symons submitted report of examination January 1, 1895. It is his opinion and that of the division engineer, concurred in by this office, that the locality is not worthy of further improvement by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 227, Fifty-third Congress, third session. (See also Appendix T T 23.)

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3. Preliminary examination of Quillayute Harbor and River, Washington.—Captain Symons submitted report of examination January 1, 1895. In his opinion, the river and harbor are worthy of improvement to the extent of closing the existing entrance and opening the former entrance of the river into Quillayute Harbor; the division engineer regards Quillayute Harbor as worthy of improvement by the General Government; the views of these officers are concurred in by this office. It is estimated that it will cost $200 to make the requisite survey and prepare plans and estimate for the work of improvement. The report was transmitted to Congress and printed in House Ex. Doc. No. 230, Fifty-third Congress, third session. (See also Appendix T T 24.)

4. Preliminary examination of Clallam Bay, Washington, with a view to its improvement as a harbor of refuge.—Captain Symons submitted report of examination January 1, 1895. It is his opinion and that of the division engineer, concurred in by this office, that this improvement is not worthy of being undertaken by the General Government. The report was transmitted to Congress and printed in House Ex. Doc. No. 226, Fifty-third Congress, third session. (See also Appendix T T 25.)

5. Preliminary examination from Hoods Canal, in Puget Sound, Washington, to North Bay, in said Sound, with a view of constructing a waterway and channel between the two bodies of water at the most practicable place, of sufficient depth to be navigable for all classes of vessels.—Captain Symons submitted report of examination January 1, 1895. He is of the opinion that the slight advantages to be derived from the proposed waterway and channel, combined with its enormous cost, render the improvement unworthy to be undertaken by the United States Government at the present time; and the division engineer regards this locality as not worthy of improvement. Their views are concurred in by this office. The report was transmitted to Congress and printed in House Ex. Doc. No. 240, Fifty-third Congress, third session. (See also Appendix T T 26.)

6. Preliminary examination of Bellingham Bay, Washington.—Captain Symons submitted report of examination January 1, 1895. In regard to the shoaling in the northwestern portion of the bay about the mouth of Nooksack River, Captain Symons states that—

> While it seems desirable and advisable to make a survey to determine the amount and rate of shoaling and to arrive at a satisfactory and definite understanding thereof, I am not, with my present knowledge, of the opinion that in this particular feature Bellingham Bay is worthy of improvement by the General Government.

He is of opinion, however, concurred in by the division engineer and by this office, that the locality is worthy of improvement to the extent of removing Starr Rock. It is estimated that a survey necessary for the preparation of project for removal of Starr Rock, with estimate, will cost $100.

The cost of a survey to determine the extent of shoaling over the entire area of the bay is estimated at $1,000.

The report was transmitted to Congress and printed in House Ex. Doc. No. 228, Fifty-third Congress, third session. (See also Appendix T T 27.)

7. Preliminary examination of Okanogan River, Washington, from mouth to head of navigation.—Captain Symons submitted report of examination January 1, 1895. It is his opinion that the locality is worthy of improvement by the General Government, and his views are concurred in by the division engineer and by this office. It is estimated that the survey of the river, on which to base a project for its improvement, will cost $1,000. The report was transmitted to Congress and

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printed in House Ex. Doc. No. 238, Fifty-third Congress, third session. (See also Appendix T T 28.)

8. Preliminary examination of Flathead River, from Columbia Falls, in Montana, to its mouth at Flathead Lake, and from its outlet on the south at Flathead Lake to the Clarks Fork of the Columbia River.—The report of results of this examination was submitted by Captain Symons under date of August 5, 1895. It is his opinion, concurred in by Colonel Mendell, the division engineer, and by this office, that the only portion of the river that is worthy of improvement by the General Government is that part between Demarsville and Flathead Lake, and that between these limits it is worthy of improvement to the extent of removing troublesome snags. No survey is necessary to preparation of project with estimate of cost of improvement. (See Appendix T T 29.)

9. Preliminary examination of Pend d'Oreille River, from Flathead Lake to Jocko Station, Montana.—The item in the river and harbor act of August 17, 1894, providing for this examination, was probably inserted through misapprehension due to a confusion of names of the rivers in that section of the country, as the waterway between the points named and to its junction with the Missoula is called Flathead River. The examination provided for by the act is therefore included in the above-mentioned report on that river. (See Appendix T T 29.)

10. Preliminary examination of North River, Washington, from its mouth in Willapa Bay, upward 25 miles.—Report of the results of this examination was submitted by Captain Symons under date of April 23, 1895. It is his opinion, concurred in by Colonel Mendell, the division engineer, and by this office, that the river from its mouth for 25 miles upward is worthy of improvement by the General Government. It is estimated that a survey necessary for preparation of plan of improvement, with estimates, will cost $750. (See Appendix T T 30.)

11. Preliminary examination of Kootenai River from Jennings, in Montana, to the international boundary, with a view of removing rocks and obstructions in the canyon above the town of Jennings.—The report of the results of this examination was submitted by Captain Symons under date of August 5, 1895. It is his opinion, concurred in by the division engineer and by this office, that the river is worthy of improvement by the General Government to the limited extent outlined by the law. It is estimated that the survey necessary to the preparation of plan and estimates of improvement will cost $500. (See Appendix T T 31.)

12. Survey at Port Orford, Oregon.—Captain Symons submitted report of survey January 30, 1895. He submits estimates for the construction of wharves for commercial shipping purposes as follows, the greater cost providing a larger enrockment: Graveyard Point Wharf, $168,366 and $203,366; Nellys Point Wharf, $195,888 and $308,388.

Captain Symons states that—

> If the Nellys Point Wharf be built without the Graveyard Point Wharf it will cost, in addition to the above, $62,000 for railroad to quarry, locomotives, cars, quarry outfit, and wharf derrick. This would make the Nellys Point Wharf cost, with the small enrockment, $257,888, and with the large enrockment, $370,388.

The division engineer states that—

> It is not plain that the harbor would be improved to any great extent, if at all, by one or both of the piers extended from the promontories Graveyard and Nelly, neither of which is in topography well suited for commercial operations.

The report was transmitted to Congress and printed in House Ex. Doc. No. 313, Fifty-third Congress, third session. (See also Appendix T T 32.)

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13. Survey of Coos River, Oregon.—Captain Symons submitted report of survey January 1, 1895. The plan of improvement proposed by him provides for removing all snags which are troublesome or liable soon to become so and to clear the bowlders from a selected channel way through the shoals 50 feet in width. The total estimated cost of the work is $5,000. The report was transmitted to Congress and printed in House Ex. Doc. No. 237, Fifty-third Congress, third session. (See also Appendix T T 33.)

14. Survey of Alsea River, Oregon.—Captain Symons submitted report of survey January 1, 1895. The project submitted by him proposes the improvement of the downstream navigation of the river at the higher stages from the forks to the head of tide by the removal of rocks and other obstructions, at an estimated cost of $3,000. The report was transmitted to Congress and printed in House Ex. Doc. No. 235, Fifty-third Congress, third session. (See also Appendix T T 34.)

15. Survey of Nestucca River, Oregon, from town of Woods to the ocean.—Captain Symons submitted report of survey January 1, 1895. He submits a project for the removal of a rocky reef which forms a dangerous obstruction at the entrance to Nestucca Bay, at an estimated cost of $6,000, and states that—

> No estimate is made for the improvement of the river between the cannery and the town of Woods, it furnishing now fairly good facilities for navigation with small boats, and the situation being such as to render it extremely difficult, if not impossible, to make any betterment of a marked and permanent character.

The report was transmitted to Congress and printed in House Ex. Doc. No. 224, Fifty-third Congress, third session. (See also Appendix T T 35.)

16. Survey of Nooksack River, Washington.—Captain Symons submitted report of survey January 14, 1895. He states that the great trouble with the navigation of the river is at its mouth and submits alternative plans for improvement at that point, at an estimated cost of $25,000 under either plan. He further states that if the mouth could be opened and kept open the expense of keeping the river itself free from snags could properly be borne by the general appropriation for snagging in Puget Sound and tributary waters, and no estimate is therefore made for this work. The report was transmitted to Congress and printed in House Ex. Doc. No. 276, Fifty-third Congress, third session. (See also Appendix T T 36.)

17. Plan and estimates for improvement of Kootenai River, Idaho.—Captain Symons submitted report of survey January 1, 1895. The plan of improvement proposed by him contemplates removal of snags and overhanging trees from the river between Bonners Ferry and the international boundary line, at a total estimated cost of $5,000. The report was transmitted to Congress and printed in House Ex. Doc. No. 233, Fifty-third Congress, third session. (See also Appendix T T 37.)

18. Survey of Grays Harbor and its bar entrance, Washington, with a view to the improvement of its channels.—The results of this survey were submitted by Captain Symons in his report of March 20, 1895, in which he proposes the construction of a single high-tide rubble-stone jetty, founded on Point Hanson and extending from the receiving wharf 25,500 feet out to sea, for the purpose of concentrating and directing upon the bar in a fixed location sufficient of the ebbing and flooding waters to scour across the bar a permanent channel of ample depth for all purposes of navigation. In the opinion of Captain Symons the plan proposed would give a permanent bar channel with an ordinary depth of at least 24 feet at the mean of the lower low waters. The estimated cost of this work is $1,000,000.

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Colonel Mendell, the division engineer, in forwarding the report of Captain Symons, dissented with the local officer in his opinion as to the sufficiency of a single jetty to secure the desired channel at this locality, and Captain Symons was accordingly requested to submit a further report upon the subject, which he did under date of May 22, 1895. In this supplementary report Captain Symons adheres to the opinion expressed in his report of March 20. He has, however, laid down in dotted lines upon his map the north jetty about as outlined by Colonel Mendell, and submits an estimate amounting to $1,363,309 as the cost of this additional work. In forwarding this second report Colonel Mendell recommends the project of improvement by two jetties, their exact location to be determined upon final approval of plans. I concur in the opinion of Colonel Mendell and in the estimate of $2,363,309. (See Appendix T T 38.)

19. Survey of Columbia River, Washington, from Rock Island Rapids to the Okanogan River.—Report of the results of this survey was submitted by Captain Symons under date of May 22, 1895. He states that the river throughout this reach has ample water for all purposes of navigation, and the only impediments consist in the swift currents, combined in some instances with rocks which are dangerous only by reason of the swift currents, which render maneuvering difficult and uncertain. The obstructions can be avoided, however, by careful piloting, and the strong currents can be steamed without lining and without much risk of damage, excepting at certain stages in three places, namely, Methow Rapids, Entiat Rapids, and Rocky Reach.

The improvement proposed, with estimates of cost of the work, is as follows:

Rock removal at Methow Rapids	$7,950
Boom at Entiat Rapids	1,037
Rock removal at Rocky Reach	3,000
Work on eight minor gravel bars	8,000
Total	19,987

The river and harbor act of August 17, 1894, contains an item allowing the expenditure of the balance of the appropriation made for the improvement of the river between Rock Island Rapids and Priest Rapids in improving this stretch of the river from Rock Island Rapids to Foster Creek Rapids, which latter is just above the mouth of the Okanogan River. The amount thus rendered available was $8,005.02. Deducting this from the total amount of the estimate leaves $11,981.80 as the amount required to carry to completion the project now submitted. (See Appendix T T 39.)

IMPROVEMENT OF WILLAMETTE AND LOWER COLUMBIA RIVERS AND THEIR TRIBUTARIES, OREGON AND WASHINGTON.

This district was in the charge of Maj. James C. Post, Corps of Engineers, with Lieut. Harry Taylor, Corps of Engineers, under his immediate orders; Division Engineer, Col. G. H. Mendell, Corps of Engineers.

1. Mouth of Columbia River, Oregon and Washington.—The project for this work was adopted in 1884, and contemplated securing and maintaining a channel depth of 30 feet across the bar at the mouth of the river by the construction of a jetty to extend from the shore near Fort Stevens across Clatsop Spit in the direction of a point about 3 miles south of Cape Disappointment, the ultimate length and height of the work to be determined from the effect produced during construction. The jetty was to be built of rubble and random blocks of stone of large size resting upon mattresses of brush.

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Prior to commencing the work of construction in 1885 the channel or channels across the bar varied both in location and depth, the latter being usually from 19 to 21 feet, while the channels, from one to three in number, shifted through nearly 180° from Cape Disappointment to Point Adams.

In March, 1893, the success of the project having been practically assured, the question as to the length and height of the completed jetty was referred to a Board of Engineers, who concluded that the existing length of 4¼ miles was sufficient, but recommended that it be raised at the inshore end to a height of 12 feet above mean level of the lower low waters, sloping to 10 feet 1⅛ miles from shore, and thence to 4 feet above this datum at the outer end. The Board also recommended the construction of four groins or spurs on the channel side to accelerate the accumulation of sands on this side, and thus add to the stability of the work.

The amount expended on this improvement to the close of the fiscal year ending June 30, 1894, was $1,669,331.10. Up to this time the jetty had been raised to its completed height for 10,000 feet at the outer end and for 1,420 feet at the inshore end. Between these portions the height varied from 7.5 feet above low water at station 150 to 10 feet above low water at station 40. The height for 2,200 feet at the outer end had, however, been reduced from 1 to 4 feet as the result of heavy gales in the latter part of 1893, and the elevated railway for 1,800 feet at the outer end had also been practically destroyed. Two of the four groins recommended by the Board had also been constructed.

During the year ending June 30, 1895, 136,900.1 tons of rock was added to the jetty, which was raised to its completed height for a length of about 3¼ miles (station 53 to station 230). Groins Nos. 3 and 4, each 1,000 feet long, were also finished, and the main line of the jetty, with the exception of about 700 feet at the inshore end, where some additional rock is still required, was completed. An elevated track for use in constructing the shore revetment has been built, and the mattress work for foundation of this revetment, which has a total length of 3,675 feet, has been nearly finished.

Soundings taken in May and June, 1895, show that there is now a direct channel over the bar seven-eighths of a mile wide and 30 feet deep at low water, and that for a width of one-half mile the low-water channel depth is at least 31 feet.

July 1, 1894, balance unexpended		$18,168.90
Amount appropriated by act of August 17, 1894		338,180.00
		356,348.90
June 30, 1895, amount expended during fiscal year		167,726.36
July 1, 1895, balance unexpended		188,622.54
July 1, 1895, outstanding liabilities	$21,296.56	
July 1, 1895, amount covered by uncompleted contracts	36,859.15	
		58,155.71
July 1, 1895, balance available		130,466.83

(See Appendix U U 1.)

2. Columbia and Lower Willamette rivers below Portland, Oreg.— The project for improving these rivers, adopted in 1877 and modified in 1891, contemplates securing a channel from Portland to the sea having a low-water depth of 25 feet. Prior to commencing the improvement the low-water depth of the channel was from 10 to 15 feet in the shoalest places. Up to 1891 this depth had been increased to 19 feet by the construction of dams at Swan Island Chute, at Willamette Slough, and at other sloughs in the Willamette River near its mouth, and of a dike

at St. Helens and dams at Burke Slough and Martin Slough in the Columbia River, the effect of these works being aided by dredging and bank protection where most needed.

Since the modification of the project so as to secure a channel depth of 25 feet, dikes have been built by the port of Portland at St. Johns and Post-Office bars in the Willamette River, and at Walkers Island, Snag Island, and Cathlamet Bay in the Columbia River. This corporation has also dredged the channel at Swan Island and Post-Office Bar in the Willamette River, and in the Columbia River at the mouth of the Willamette, at St. Helens, at Martins Island, at Walkers Island, and in Cathlamet Bay, removing a total of 320,241 cubic yards of material at these points.

The work done by the United States has consisted in extending the dike at St. Helens, in constructing a dike at Martins Island, in the Columbia River, in dredging the channels of both rivers at various places, and the removal of snags wherever necessary.

In September, 1893, as a result of these improvements, deep-draft vessels were for the first time able to pass fully loaded from the docks in Portland to the sea, thus avoiding the previous heavy expense for lightering.

The net amount expended on this improvement by the United States to the close of the fiscal year ending June 30, 1894, was $1,025,610.87, of which $803,830.41 was expended under the projects adopted in 1877 and extended in 1891.

During the year ending June 30, 1895, the dike at Martins Island has been thoroughly repaired, and dredging has been carried on to maintain, and, as far as practicable, to increase the depth of the channel from Portland to the sea, the total quantity of material removed being 423,372 cubic yards. In the Willamette dredging was done at Post Office Bar and at the mouth of the river, and in the Columbia River, on the bars at Hunters Point, at Martins Island, at Pillar Rock, at Walkers Island, and opposite Astoria.

Vessels drawing 20 feet can now pass over the shoalest places at low water, and, by taking advantage of the tides, vessels drawing 23 feet or more can come to Portland without difficulty.

July 1, 1894, balance unexpended	$4,754.13
Amount appropriated by act of August 17, 1894	50,000.00
	54,754.13
June 30, 1895, amount expended during fiscal year	30,088.85
July 1, 1895, balance unexpended	24,665.28
July 1, 1895, outstanding liabilities	2,405.06
July 1, 1895, balance available	22,260.22
Amount (estimated) required for completion of existing project	572,464.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	50,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix U U 2.)

3. Columbia River between Vancouver, Wash., and the mouth of Willamette River.—The project for this improvement, adopted in 1892, provides for the construction of a low dam across the slough on the Oregon side of Hayden Island to increase the volume of water, and by the additional scour to remove a troublesome bar in the main channel.

The dam was built under contract, but the contractors having failed to close a gap of about 60 feet near the island end the contract was annulled in February, 1894, at which time the gap had been greatly

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widened by scour from the head of the island. The funds on hand being insufficient for the proper completion of the work, a contract was made for so repairing the dam as to provide against further injury by floods.

The work done under this latter contract, prior to the flood of 1894, was principally confined to revetting the bank at the head of the island to prevent further scour, but during the flood this revetment was entirely destroyed, and it was considered useless to attempt further repairs with the funds on hand.

Work during the fiscal year has consisted in dredging the bars on the north side of the island for the relief of navigation, the depth on these bars having been increased from 9 feet to 13 feet at low water.

July 1, 1894, balance unexpended	$4,120.83
June 30, 1895, amount expended during fiscal year	3,361.53
July 1, 1895, balance unexpended	759.30
July 1, 1895, outstanding liabilities	267.15
July 1, 1895, balance available	492.15

(See Appendix U U 3.)

4. Canal at the Cascades, Columbia River, Oregon.—The object of this improvement, the project for which was adopted in 1877 and subsequently modified in 1880 and 1886, was to provide for navigation between the lower and middle portions of the Columbia River, the plan being to construct a canal at the upper end of the reach of 4½ miles where the river flows through a narrow gorge in the Cascade Mountains, this canal to be 3,000 feet long, with a lock to overcome the low-water fall of 24 feet in this distance, and to provide for navigation up to a stage of 20 feet above low water, and to remove the rocks from the rapids below so that this portion of the reach might be navigable at all ordinary stages of the river.

The improvement of the rapids had been completed and considerable progress made in constructing the canal and lock, by hired labor, when, under authority conferred by the river and harbor act of July 13, 1892, which appropriated $326,250 for the work, a contract for completing the improvement was entered into with Messrs. J. G. & I. N. Day.

This contract, which was approved January 24, 1893, provided that the sum appropriated, less engineering expenses, should be earned within one year from date of its approval, and that the amount of each subsequent appropriation should be earned within one year from the date at which it was made. The total liability to be incurred under contract was limited by the act to the sum of $1,419,250, "exclusive of the amount herein and heretofore appropriated."

The sundry civil act of March 3, 1893, appropriated the further sum of $1,239,653 for continuing the improvement, with the proviso that not more than three-fourths of this appropriation should be expended during the fiscal year ending June 30, 1894.

In January, 1894, the time for completing the contract under the appropriations already made was fixed at March 3, 1895, and a further extension of time to March 3, 1896, was granted in February last.

Preliminary work under the contract was begun in March, 1893. Actual construction was begun on the 12th of October following and has been continued to the present time, except that work was interrupted by high water for four months in 1894 and for two weeks in 1895.

During the fiscal year just ended 27,050 cubic yards of concrete and 17,230 cubic yards of stone masonry were laid, and 18,483 cubic yards

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of rock and 81,946 cubic yards of loose material were excavated. The lower guard gates and the lower lock gates have been completed and the upper guard gates are in place. The upper lock gates, for which the material is on hand, are yet to be put in place. The vertical walls of the canal below the lock are about completed, the walls of the lock are practically finished, and the vertical walls of the canal above the upper guard gate are about completed, except where they are interrupted by the upper bulkhead. The paving of the slopes is also well advanced.

Subsequent to the flood of 1894 some modifications of the project were recommended by the officer in charge so as to provide for the security of the work in case of a recurrence of the unprecedented high water of that year; and it having been demonstrated that steamers can ascend the rapids to the mouth of the canal at stages much higher than was originally contemplated, modifications were also proposed by which the canal could be made available for the passage of boats at all the stages during which it can be reached. This matter was submitted to a Board of Officers of the Corps of Engineers, whose report, dated October 18, 1894, was printed in Senate Ex. Doc. No. 26, Fifty-third Congress, third session. It is also submitted herewith. It is estimated that the proposed modifications will cost $413,360, and it would be of great advantage to the work if this sum were appropriated for the next fiscal year. Congress, however, by the act of July 13, 1892, limited the contract liability of the United States for this work to $1,745,500, and the estimate submitted for the fiscal year 1897 is for the balance of this amount remaining unappropriated.

July 1, 1894, balance unexpended		$1,233,353.38
June 30, 1895, amount expended during fiscal year		640,998.44
July 1, 1895, balance unexpended		592,354.94
July 1, 1895, outstanding liabilities	$18,462.57	
July 1, 1895, amount covered by uncompleted contracts	569,998.47	
		588,461.04
July 1, 1895, balance available		3,893.90
Amount (estimated) required for completion of existing project		413,360.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		179,597.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix U U 4.)

5. Columbia River at Three Mile Rapids, and the construction and equipment of a boat railway from the foot of The Dalles Rapids to the head of Celilo Falls, Oregon and Washington.—Pursuant to the requirements of the river and harbor act of August 17, 1894, which appropriated $100,000 for this improvement, the line of the proposed boat railway has been definitely located. It begins at Big Eddy and terminates above Celilo Falls, and has a total length of 9 miles. The line as located is considered most favorable, having but 4 curves, each of one-half degree, and the maximum grade being but 13¼ feet per mile. The low-water lifts at the upper and lower terminals are 62 feet and 77 feet, respectively.

Negotiations have been commenced for securing the right of way and the right to the use of lands for the purposes of the boat railway, but the prices named by the principal land owners being considered excessive, it has been determined to acquire the right of way by condemnation. In the case of but two small tracts have the prices demanded by the owners been considered reasonable. In these cases the proposals

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have been accepted. Further proceedings for acquiring the right of way are now in charge of the Department of Justice.

It is now believed that the boat railway can be thoroughly constructed and equipped, and that the work, including the improvement of Three Mile Rapids, can be completed for the amount estimated by the Board of Engineers in 1892, viz, $2,264,467.

Amount appropriated by act of August 17, 1894	$100,000.00
June 30, 1895, amount expended during fiscal year	3,341.10
July 1, 1895, balance unexpended	96,658.90
July 1, 1895, outstanding liabilities	150.00
July 1, 1895, balance available	96,508.90
Amount (estimated) required for completion of existing project	2,264,467.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix U U 5.)

6. Willamette River, above Portland, and Yamhill River, Oregon.—At the time of the adoption of the present project, in 1878, the mouth of the Yamhill River, 40 miles above Portland, was the head of low-water navigation, with a draft of 2½ feet. Above this point the controlling depth was but 1 foot.

The project of 1878 contemplates the improvement of the river by the removal of obstructions and the construction of dikes to contract the waterway at shoal places, so as to secure a navigable channel for light-draft boats from Portland to Eugene, a distance of 172 miles. This project was extended in 1892 to include the removal of obstructions in the Yamhill River from its mouth to McMinnville, and by the river and harbor acts of 1892 and 1894 allotments of $3,000 and $2,000, respectively, were made for this purpose from the appropriations for improving Willamette River above Portland.

The amount expended on this project to the close of the fiscal year ending June 30, 1894, was $150,228.61, of which $2,907.65 was for removing obstructions in Yamhill River.

During the past year snagging operations have been continued from Portland to Eugene on the Willamette River and to McMinnville on the Yamhill River.

The act of August 17, 1894, provided that $8,000 of the sum appropriated, or so much thereof as might be necessary, should be expended at Corvallis, where it was feared that a new channel might be formed, which would leave this place some distance inland. This allotment has been expended in constructing a revetment for bank protection in the bend below the town, the total length of the work being 4,300 feet.

July 1, 1894, balance unexpended	$3,426.25
Amount appropriated by act of August 17, 1894	23,000.00
	26,426.25
June 30, 1895, amount expended during fiscal year	14,272.28
July 1, 1895, balance unexpended	12,153.97
July 1, 1895, outstanding liabilities	790.40
July 1, 1895, balance available	11,363.57
Amount that can be profitably expended in fiscal year ending June 30, 1897	25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix U U 6.)

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7. Cowlitz River, Washington.—Prior to the adoption of the project for improving this river in 1882 the ruling low-water depth to Toledo, 30 miles above the mouth, was 14 inches.

The project contemplated the removal of sand bars and other obstructions, such as rocks, snags, and overhanging trees, to a point 50 miles from the mouth, at a cost of $5,000 for the first year and an annual expenditure of $2,000 for maintenance thereafter. In pursuance of this project, work has been done up to Toledo, to which point a low-water depth of 30 inches has been secured, and the usual season of navigation has been increased by one month.

The amount expended on this improvement up to the close of the fiscal year ending June 30, 1894, was $20,379.61.

During the last fiscal year the channel of the river below Toledo has been cleared of obstructions, and the bank in the bend just below this town has been revetted for a length of 2,000 feet to secure it against further erosion and to maintain the channel in its present favorable position. The cost of the revetment was $1.42 per linear foot.

The officer in charge estimates that $3,000 can be profitably expended on this improvement in the fiscal year 1897.

July 1, 1894, balance unexpended	$1,620.39
Amount appropriated by act of August 17, 1894	3,000.00
	4,620.39
June 30, 1895, amount expended during fiscal year	3,287.47
July 1, 1895, balance unexpended	1,332.92
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	3,000.00

(See Appendix U U 7.)

8. Youngs and Klaskuine rivers, Oregon.—The improvement of these rivers was sufficiently advanced in 1891 to give a channel depth at high tide of 7 feet from the mouth of Youngs River to the cut-off 7 miles above, and via this river to Kamm's Wharf, on the Klaskuine River, the total length of the improvement being 9 miles.

The amount expended on this improvement to June 30, 1895, is $1,222.47. No further appropriation is recommended.

July 1, 1894, balance unexpended	$377.53
July 1, 1895, balance unexpended	377.53

(See Appendix U U 8.)

9. Gauging waters of Columbia River, Oregon and Washington.—The object of this gauging is to obtain data for use in connection with the improvement of the river and to supply information to persons interested in its navigation.

The total amount expended for this purpose to June 30, 1894, was $5,000. During the last year but one gauge—that at Astoria—has been in operation.

An estimate of $1,000 for continuing the work is submitted by the officer in charge.

Amount appropriated by act of August 17, 1894	$1,000.00
June 30, 1895, amount expended during fiscal year	351.00
July 1, 1895, balance unexpended	649.00
July 1, 1895, outstanding liabilities	57.00
July 1, 1895, balance available	592.00
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	1,000.00

(See Appendix U U 9.)

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EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF AUGUST 17, 1894.

The preliminary examinations and surveys of the following localities, required by the act of August 17, 1894, were made by the local engineer, Maj. James C. Post, Corps of Engineers, and reports thereon submitted through the division engineer, Col. G. H. Mendell, Corps of Engineers:

1. Preliminary examination of Clatskanie River, Oregon, from mouth to town of Clatskanie.—Major Post submitted report of examination February 7, 1895. He is of opinion that the river is worthy of improvement by the General Government and states that it is believed that sufficient data have been obtained for the preparation of an estimate of the cost of the proposed work. His views are concurred in by the division engineer and by this office. The report was transmitted to Congress and printed in House Ex. Doc. No. 330, Fifty-third Congress, third session. (See also Appendix U U 10.)

2. Preliminary examination of Tualiton River to Hillsboro, Oreg., and to the head of navigation.—Major Post submitted report of examination February 13, 1895. He does not deem this river worthy of improvement by the General Government, and his opinion is concurred in by the division engineer and by this office. The report was transmitted to Congress and printed in House Ex. Doc. No. 344, Fifty-third Congress, third session. (See also Appendix U U 11.)

3. Preliminary examination of Lewis River, Washington, from La Center to its mouth, with a view of deepening the channel and improving the navigation.—Major Post submitted report of examination February 8, 1895. He states that it would be a great benefit to navigation if the depth on the shoals between the forks and La Center could be increased to 2 feet at low water, or to the same depth as exists upon the shoals in the river below the junction, and it is his opinion, concurred in by the division engineer and by this office, that this locality is worthy of improvement by the General Government to this extent. It is estimated that a survey of the river from the Columbia River to La Center, for preparation of project and estimate of cost of improvement, would cost $600. The report was transmitted to Congress and printed in House Ex. Doc. No. 331, Fifty-third Congress, third session. (See also Appendix U U 12.)

4. Survey of Yamhill River, Oregon, up to the town of McMinnville, with a view of improving the same by locks and dams or otherwise.—The report of the results of this survey was submitted by Major Post, March 6, 1895, in which he estimates that the lock and dam and other necessary work for making the river navigable to McMinnville for a draft of 3½ feet during the entire year will cost $69,000.

Under the provisions of the river and harbor act of July 13, 1892, a preliminary examination was made of this river from its mouth to McMinnville, for slack-water navigation by lock and dam at Lafayette, and the report of the local engineer, Maj. Thomas H. Handbury, was submitted by the Chief of Engineers to the Secretary of War with letter of December 17, 1892 (see Annual Report of the Chief of Engineers for 1893, p. 3531), in which he uses the following language:

Major Handbury states that it does not appear that the present or prospective commerce of the river or that the anticipated reduction in railroad freight rates at shipping points along its course are of sufficient importance to the General Government to warrant that it enter upon a project for the further improvement of the river by a lock and dam at Lafayette or any other more suitable place along its course.

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The division engineer, in forwarding the report to this office, expresses the opinion that the river is not worthy of the degree of improvement necessary to give slack-water navigation as far as Lafayette, and I concur in his views.

The report of Major Post of the results of the survey provided for by the river and harbor act of August 17, 1894, is submitted herewith. (See Appendix U U 13.)

5. Survey of Columbia River, Oregon, below Tongue Point, by way of the southern channel, in front of Astoria.—The results of this survey were submitted by Major Post in his report of May 25, 1895. The present project for improvement of the Columbia and Willamette rivers between Portland and the sea contemplates securing a low-water depth of 25 feet throughout this distance. The south channel in front of Astoria is a necessary part of this deep channel and its improvement was proposed when the project was submitted in 1891. At that time there was but little work considered necessary in order to obtain the required depth in this channel, and only a small item for dredging at this locality is included in the estimate, but the deterioration of the channel developed by the present survey renders additional work necessary, and it is proposed in making the improvement to open a waterway in front of Astoria 25 feet deep and 250 feet wide at the bottom, in accordance with the general project for the river. This will include opening, by dredging, a more direct channel of these dimensions from Tongue Point to below the wreck of the *Sylvia de Grasse* and the removal of the outer portion of the Sylvia de Grasse ledge. This work will, it is estimated, cost $121,550. (See Appendix U U 14.)

Major Post was also charged with the duty of making survey of Willamette River from Portland to Eugene, Oreg., the report of the results of which will be duly submitted when received.

EXAMINATIONS, SURVEYS, AND CONTINGENCIES OF RIVERS AND HARBORS.

For examinations, surveys, and contingencies of rivers and harbors an appropriation of $200,000 should be made, as follows:

For examinations, surveys, and contingencies, and for incidental repairs for rivers and harbors, for which there may be no special appropriation; for expenses connected with the inspection of bridges reported as obstructions to navigation, the service of notice required in such cases, and the location of harbor lines as required by the act of September 19, 1890; and for expenses connected with the examinations and reports by officers of the Corps of Engineers and by boards of engineers, upon plans for bridges authorized by law to be constructed, and upon bridge bills, reports on which may be called for by Congress, $200,000.

SUPERVISION OF THE HARBOR OF NEW YORK.

The supervisor of the harbor during the year was Lieut. Commander Daniel Delehanty, United States Navy.

The office of supervisor of the harbor of New York was created by act of Congress approved June 29, 1888, entitled "An act to prevent obstructive and injurious deposits within the harbor and adjacent waters of New York City by dumping or otherwise, and to punish and prevent such offenses." This act has been amended by section 3 of the act of August 17, 1894, entitled "An act making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes," by which amendment the functions and powers of the officer have been greatly enlarged. Additional duties are also conferred on the supervisor by section 2 of the last-named act.

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Under the provisions of section 5 of the act of June 29, 1888, a line officer of the Navy is designated to discharge the duties created by the act under the direction of the Secretary of War. On May 23, 1889, the Secretary of War directed that all communications in connection with these duties should be addressed to him through this office, and on February 1, 1890, he further directed that the powers conferred upon him by the act should be exercised through the Chief of Engineers.

The report of Lieutenant-Commander Delehanty, describing the operations in his charge for the fiscal year ending June 30, 1895, is submitted as Appendix V V.

Estimates for the fiscal year ending June 30, 1897.—The estimate of funds required for this service for the fiscal year ending June 30, 1897, is given in the above-mentioned report, as follows:

For pay of inspectors, deputy inspectors, office force and expenses of office, and maintenance of launches *Active*, *Alert*, and *Lookout*	$18,000
For pay of crew and maintenance of steamer *Nimrod*	10,000
For pay of crew and maintenance of steamer *Argus*	10,000
For pay of crew and maintenance of steamer *Daniel S. Lamont*	12,000
For pay of crew and maintenance of one steam tug under construction	12,000
Total	62,000

MISSISSIPPI RIVER COMMISSION.

The Mississippi River Commission, constituted by act of Congress of June 28, 1879, is in charge of the improvement of Mississippi River between the mouth of the Ohio River and the Head of the Passes and of surveys of the entire river.

The Commissioners during the past fiscal year were: Col. C. B. Comstock, Corps of Engineers, president (to February 3, 1895), and Lieut. Col. G. L. Gillespie, Corps of Engineers, since February 13, 1895 (president since February 15, 1895); Lieut. Col. Charles R. Suter, Corps of Engineers; Lieut. Col. Amos Stickney, Corps of Engineers; Henry L. Whiting, assistant, United States Coast and Geodetic Survey; B. M. Harrod, Robert S. Taylor, and Henry Flad.

The report of the Commission upon the operations under its charge during the fiscal year ending June 30, 1895, is submitted as Appendix W W.

Estimates for the fiscal year ending June 30, 1897.—The following estimates of funds required for carrying on the works under its charge for the year ending June 30, 1897, are submitted by the Commission:

For improving Mississippi River from Head of the Passes to the mouth of the Ohio River, including salaries, clerical, office, traveling and miscellaneous expenses of the Mississippi River Commission	$3,000,000
For improving harbors at—	
New Madrid, Mo	60,000
Memphis, Tenn	72,000
Greenville, Miss	150,000
Delta Point, Louisiana	150,000
Natchez, Miss., and Vidalia, La	385,000
New Orleans, La	300,000
For improvement at head of Atchafalaya and mouth of Red River, Louisiana	300,000
Total	4,417,000

MISSOURI RIVER COMMISSION.

The Missouri River Commission, constituted by act of Congress of July 5, 1884, is in charge of the improvement and surveys of the Missouri River below Sioux City, Iowa.

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The Commissioners during the past fiscal year were Lieut. Col. Charles R. Suter, Corps of Engineers, president; Lieut. Col. A. Mackenzie, Corps of Engineers; Maj. Charles J. Allen, Corps of Engineers, G. C. Broadhead, and R. S. Berlin.

The report of the Commission upon the operations under its charge for the fiscal year ending June 30, 1895, is submitted as Appendix X X.

Estimates for the fiscal year ending June 30, 1897.—The following estimates of funds required for carrying on the works under its charge for the year ending June 30, 1897, are submitted by the Commission:

Office and traveling expenses and salaries of Commission	$25,000	
Surveys, gauges, physical data, and publications	35,000	
Operating snag boat	40,000	
Systematic improvement in First Reach	900,000	
		$1,000,000
Improving Osage River, Missouri.		
Completion of lock and dam at Brennekes Shoal	$131,800	
Snagging, etc	8,200	
		140,000
Improving Gasconade River, Missouri.		
Snagging and improvement of shoals, etc		20,000
Total		1,160,000

CALIFORNIA DÉBRIS COMMISSION.

Act of Congress approved March 1, 1893, provided for the establishment of the California Débris Commission, to consist of three officers of the Corps of Engineers, appointed by the President, with the concurrence of the Senate, whose functions relate to hydraulic mining in the territory drained by the Sacramento and San Joaquin river systems in California. The Commission is empowered and required to adopt plans for improving the navigation of the rivers in the systems mentioned, to project and construct works for impounding detritus and preventing the deterioration of the rivers from the deposit of hydraulic mining and other débris, and to devise means and issue permits for resuming and carrying on hydraulic mining operations under conditions that will not injure other interests in the State. The powers of the Commission, methods of proceedure, etc., are precribed in the act in detail.

The Commissioners appointed by the President May 3, 1893, are Col. G. H. Mendell, Lieut. Col. W. H. H. Benyaurd, and Maj. W. H. Heuer, Corps of Engineers. Lieut. Cassius E. Gillette, Corps of Engineers, has been on duty under orders of the Commission since September 6, 1893.

The second annual report of the Commission, submitted November 15, 1894, detailing the operations of the Commission up to that date, was transmitted to Congress and printed in House Ex. Doc. No. 11, Fifty-third Congress, third session. A copy of this report and the report of the Commission upon operations up to the close of the fiscal year ending June 30, 1895, are submitted herewith as Appendix Y Y.

HARBOR LINES.

The existing provisions of United States law relating to the establishment of harbor lines are contained in section 12 of the river and act approved September 19, 1890, as follows:

SEC. 12. That section 12 of the river and harbor act of August 11, 1888, be amended and reenacted so as to read as follows:

Where it is made manifest to the Secretary of War that the establishment of harbor lines is essential to the preservation and protection of harbors he may, and

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is hereby authorized to, cause such lines to be established beyond which no piers, wharves, bulkheads, or other works shall be extended or deposits made, except under such regulations as may be prescribed from time to time by him; and any person who shall willfully violate the provisions of this section, or any rule or regulation made by the Secretary of War in pursuance of this section, shall be deemed guilty of a misdemeanor, and on conviction thereof shall be punished by a fine not exceeding $1,000, or imprisonment not exceeding one year, at the discretion of the court, for each offense.

Cases where the establishment of harbor lines at particular harbors has appeared to be essential to their preservation and protection have been considered by the local engineer officers or by boards of engineers constituted for the purpose, and reports thereon submitted, with maps, indicating the lines recommended for establishment by the War Department; and the reports have been submitted to the Secratary of War with the recommendations of this office. Under the provisions of the law and in this manner harbor lines have been established by the Secretary during the year at the following localities, the correspondence and reports being submitted as appendixes to this report:

1. *Rockland Harbor, Maine.*—Pursuant to request of local interests and in accordance with recommendation of Maj. (now Lieut. Col.) D. P. Heap, Corps of Engineers, January 15, 1895, harbor lines at Rockland were established by the Secretary of War January 18, 1895. (See Appendix A 27.)

2. *New Haven Harbor, Connecticut.*—In accordance with recommendation of Lieut. Col. (now Col.) H. M. Robert, Corps of Engineers, dated November 10, 1894, upon resolution of the board of harbor commissioners for New Haven Harbor, the harbor lines for this locality established by the general assembly of the State of Connecticut were approved by the Secretary of War November 17, 1894. Subsequently, upon application of local interests, Colonel Robert recommended a modification of the lines south of the Barnstable Bridge, and these modifications were approved by the Secretary of War March 2, 1895. An amended description of these modified lines submitted by Colonel Robert May 16, 1895, was approved by the Secretary May 20, 1895. (See Appendix D 39.)

3. *Milford Harbor, Connecticut.*—Pursuant to the request of local interests and in accordance with the recommendation of Lieut. Col. (now Col.) H. M. Robert, Corps of Engineers, in his report of September 1, 1894, harbor lines at this locality were established by the Secretary of War September 6, 1894. (See Appendix D 40.)

4. *East River, New York, in the vicinity of Rikers Island.*—Complaint having been made against the construction by the city of New York of a dike at this place which would prevent the free navigation of waters in its vicinity, and application made by local navigation interests for modification of the harbor lines established by the Secretary of War, January 24, 1893 (see Annual Report, Chief of Engineers, 1893, pp. 461 and 1085), the subject was referred to the Board of Engineers on harbor lines for New York Harbor and its adjacent waters, and its report of October 3, 1894, recommended a modification of the existing lines. The modification proposed by the Board was approved by the Secretary of War October 29, 1894. (See Appendix E 37.)

5. *Pittsburg Harbor, Pennsylvania.*—For the protection of the navigation interests of this locality a Board of Engineer Officers consisting of Lieut. Col. Amos Stickney, Maj. D. W. Lockwood, and Lieut. H. E. Waterman, recommended the establishment of certain harbor lines on the Monongahela and Allegheny rivers at Pittsburg, Pa., and on both sides of the Ohio River as far down as Davis Island Dam. The report,

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dated March 22, 1895, was submitted to the Secretary of War March 26, 1895, recommended for approval, and was approved by the Secretary March 29, 1895. It is printed herewith as Appendix D D 9.

6. St. Louis Bay and around Grassy Point, Minnesota and Wisconsin, and along St. Louis River above Grassy Point as far as Spirit Lake.—At the request of local interests for establishment of harbor lines at Ironton and in accordance with recommendation of Maj. C. B. Sears, Corps of Engineers, November 10, 1894, and of the division engineer, Col. O. M. Poe, Corps of Engineers, November 14, 1894, the Secretary of War, December 5, 1894, approved the proposed change in the established lines in St. Louis Bay and around Grassy Point, Minnesota and Wisconsin, and established lines along St. Louis River above Grassy Point as far as Spirit Lake. (See Appendix H H 15.)

7. Milwaukee River, between Cherry and Walnut streets, Milwaukee, Wis.—In accordance with request of local interests and recommendation of Capt. Carl F. Palfrey, Corps of Engineers, in his report of June 5, 1895, the Secretary of War approved harbor lines for this locality June 11, 1895. (See Appendix I I 27.)

8. Fox River, along the river fronts of the cities of Green Bay and Fort Howard, Wis., from the mouth, upstream, about 3.2 miles.—The establishment of harbor lines at this locality was recommended by Maj. James F. Gregory, Corps of Engineers, August 27, 1894, and by Col. O. M. Poe, Corps of Engineers, division engineer, August 29, 1894. The lines, slightly modified as recommended by this office, were approved by the Secretary of War November 10, 1894. (See Appendix I I 28.)

9. Lake St. Clair, from the lower end of Grossepoint to Milk River, Michigan.—The establishment of harbor lines at this locality having been requested by owners of property at Grossepoint, the matter was referred to Col. O. M. Poe, Corps of Engineers, and the lines recommended by him in report of March 9, 1895, were approved by the Secretary of War March 15, 1895. (See Appendix L L 8.)

10. Cleveland Harbor, Ohio.—Application having been made for a modification of the harbor lines at Cleveland, Ohio, the matter was referred to Col. H. L. Abbot, Corps of Engineers, division engineer, Northeast Division, and the modified line proposed by him in report of January 29, 1895, was approved by the Secretary of War February 1, 1895. (See Appendix M M 14.)

11. Fairport Harbor, Ohio.—Pursuant to request of the Painesville, Ohio, Board of Trade, and in accordance with recommendation of Lieut. Col. Jared A. Smith, Corps of Engineers, January 5, 1895, harbor lines at this locality were established by the Secretary of War January 11, 1895. Subsequently upon request of the Baltimore and Ohio Railroad Company and recommendation of the Painesville Board of Trade, the Secretary of War, June 20, 1895, modified the established lines so as to permit the completion of wharf being constructed by said company. (See Appendix M M 15.)

12. Buffalo Harbor, New York.—Establishment of harbor lines at Buffalo outer harbor having been requested by local interests, the subject was referred to Maj. E. H. Ruffner, Corps of Engineers, and the lines recommended by him in his report of September 26, 1894, were approved by the Secretary of War December 21, 1894. (See Appendix N N 11.)

13. Niagara River, at Buffalo, N. Y.—Local interests having requested the establishment of harbor lines at this locality, Maj. E. H. Ruffner, Corps of Engineers, for reasons stated in report of January 15, 1895, recommended that the pierhead line established by the Secre-

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tary of War July 23, 1894 (see Annual Report of the Chief of Engineers, 1894, pp. 424 and 2452), be extended southward some 3,100 feet to a point 50 feet outside of the face of the main sewer, opening some 505 feet south of the foot of Ferry street, Buffalo, N. Y., and this extended line was approved by the Secretary of War January 18, 1895. (See Appendix N N 12.)

14. Wilmington Harbor, California.—The harbor lines for this locality approved by the Secretary of War (see Annual Reports, Chief of Engineers, 1891, p. 2976, and 1892, p. 2638) having been delineated on an incorrect map, Lieut. Col. W. H. H. Benyaurd, Corps of Engineers, April 30, 1895, recommended the establishment of new lines in lieu thereof, together with additional lines in front of Smiths Island. These lines were approved by the Secretary of War May 7, 1895. (See Appendix R R 11.)

15. Puget Sound, in front of the cities of Seattle and Ballard, Wash.—In accordance with the request of the board of tide-land appraisers for King County, Wash., harbor lines in Puget Sound in front of the cities of Seattle and Ballard, Wash., adopted by the board of harbor line commissioners of that State, were, upon recommendation of Col. G. H. Mendell, Corps of Engineers, in his report of October 30, 1894, established by the Secretary of War November 17, 1894. (See Appendix T T 40.)

16. Hoquiam Harbor, Washington.—Upon request of the board of land commissioners of the State of Washington the harbor lines adopted by the board of harbor line commissioners of that State in Hoquiam River and Grays Harbor at Hoquiam, Wash., as modified by Col. G. H. Mendell, Corps of Engineers, in his report of November 17, 1894, were approved by the Secretary of War December 12, 1894. (See Appendix T T 41.)

BRIDGING NAVIGABLE WATERS OF THE UNITED STATES.

Plans and locations of the following bridges, proposed to be erected under the authority of special acts of Congress, have been examined with a view to protection of the interests of navigation, and have been approved by the Secretary of War, as provided by the acts; and the local engineer officers have been furnished with copies of the instruments of approval and drawings showing plans and locations, and charged with the supervision of the construction of the bridges so far as necessary to see that they are built in accordance with the approved plans:

1. Bridge of the Braddock and Homestead Bridge Company across Monongahela River between Homestead and Pittsburg, Pa.—The construction of this bridge was authorized by act of Congress approved June 7, 1894. The plans submitted by the company July 26, 1894, proving unsatisfactory to the navigation interests, modified plans were subsequently submitted and were approved by the Secretary of War September 20, 1894; copy sent to Maj. R. L. Hoxie, Corps of Engineers, September 22, 1894.

2. Bridge of the Calumet and Blue Island Railway Company across Calumet River at South Chicago, Ill.—The construction of this bridge was authorized by act of Congress approved March 1, 1893, as amended by the act of June 8, 1894. Plans and map of location were submitted by the company September 13, 1894; approved by the Secretary of War October 3, 1894; copy sent to Maj. W. L. Marshall, Corps of Engineers, October 4, 1894.

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3. Bridge of the Texarkana and Shreveport Railroad Company across Sulphur River, Arkansas.—Plans and map of location for the construction of this bridge under authority of act of Congress of May 28, 1894, were submitted by the company September 15, 1894; approved by the Secretary of War October 16, 1894; copy sent to Capt. J. H. Willard, Corps of Engineers, October 17, 1894.

4. Bridge of the South St. Paul Belt Railroad Company across Mississippi River at South St. Paul, Minn.—Plans and map of location of this bridge were approved by the Secretary of War February 7, 1894. (See Annual Report, Chief of Engineers, 1894, p. 425.) On October 12, 1894, the company submitted revised plans providing for increased length of some of the spans; approved by the Secretary of War November 1, 1894; copy sent to Lieut. Col. A. Mackenzie, Corps of Engineers, November 3, 1894.

5. Bridge of the Pennsylvania and New Jersey Railroad Company (of New Jersey) across Delaware River at Philadelphia, Pa.—The construction of this bridge was authorized by act of Congress approved June 14, 1894. Plans and map of location were submitted August 30, 1894, and modified plans October 11, 1894; approved by the Secretary of War November 3, 1894; copy sent to Maj. C. W. Raymond, Corps of Engineers, November 5, 1894.

6. Bridge of the Glenwood Highway Bridge Company across Monongahela River at Pittsburg, Pa.—The construction of this bridge was authorized by act of Congress approved April 2, 1894. Plans and map of location were submitted October 10, 1894; approved by the Secretary of War November 3, 1894; copy sent to Maj. R. L. Hoxie, Corps of Engineers, November 6, 1894. The bridge has been completed in accordance with the approved plans.

7. Bridge of the city of Hastings, Minn., across Mississippi River.—The construction of this bridge was authorized by act of Congress approved June 29, 1894. Plans and map of location were submitted October 17, 1894; approved by the Secretary of War November 9, 1894; copy sent to Lieut. Col. A. Mackenzie, Corps of Engineers, November 10, 1894. The bridge has been completed in accordance with the approved plans.

8. Bridge of the Chesapeake and Ohio Railway Company across Big Sandy River at Catlettsburg, Ky.—Plans for the construction of a bridge at this locality to replace the existing structure were approved by the Secretary of War February 25, 1893. (See Annual Report, Chief of Engineers, 1893, p. 464.) Modified plans, omitting the roadways and sidewalks provided for in the original plans, were submitted November 23, 1894; approved by the Secretary of War November 30, 1894; copy sent to Maj. D. W. Lockwood, Corps of Engineers, December 3, 1894.

9. Bridge of Escambia County, Fla., and Baldwin County, Ala., across Perdido River, near Holman Ferry.—The construction of this bridge was authorized by act of Congress approved August 13, 1894. Plans and map of location were submitted October 21, 1894; approved by the Secretary of War December 5, 1894; copy sent to Maj. F. A. Mahan, Corps of Engineers, December 7, 1894. The bridge has been completed in accordance with the approved plans.

10. Bridge of the Davenport and Rock Island Railway Bridge Company across Mississippi River between Davenport, Iowa, and Rock Island, Ill.—Plans for a bridge to be erected at this locality under authority of act of Congress approved March 3, 1885, were submitted November 19, 1894, and modified plans January 5, 1895; approved by the Secretary of War January 23, 1895; copy sent to Lieut. Col. A. Mackenzie, Corps of Engineers, January 25, 1895.

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11. Bridge of the Fort Smith and Van Buren Railway Company across Arkansas River, near Van Buren, Ark.—The construction of this bridge was authorized by act of Congress approved March 9, 1894. Plans and map of location were submitted February 14, 1895; approved by the Secretary of War March 8, 1895.

12. Bridge of the La Porte, Houston and Northern Railroad Company across Clear Creek, Texas.—The construction of this bridge was authorized by act of Congress approved February 1, 1895. Plans and map of location were submitted February 2, 1895; approved by the Secretary of War March 25, 1895; copy sent to Maj. A. M. Miller, Corps of Engineers, March 26, 1895.

13. Bridge of the La Porte, Houston and Northern Railroad Company across Galveston Bay, Texas.—The construction of this bridge was authorized by act of Congress approved February 1, 1895. Plans and map of location were submitted February 2, 1895; approved by the Secretary of War March 27, 1895, upon certain conditions respecting the location and requiring that the draw openings shall be 85 feet in the clear; copy sent to Maj. A. M. Miller, Corps of Engineers, March 29, 1895.

14. Bridge of the Texarkana and Fort Smith Railway Company across Little River, near Morris Ferry, Ark.—The construction of this bridge was authorized by act of Congress approved April 21, 1894, amended by act of January 19, 1895. Plans and map of location were submitted October 1, 1894. The plans were approved by the Secretary of War March 27, 1895, upon certain conditions respecting the height above low water; copy sent to Capt. J. H. Willard, Corps of Engineers, March 29, 1895.

15. Bridge of the Duluth and Superior Bridge Company across St. Louis River between Connors Point, Wisconsin, and Rices Point, Minnesota.—The construction of this bridge was authorized by act of Congress approved April 24, 1894, amended by act of August 4, 1894. Plans and map of location were submitted by the company March 18, 1895, and modified plans April 4, 1895; approved by the Secretary of War April 10, 1895; copy sent to Maj. C. B. Sears, Corps of Engineers, April 11, 1895.

16. Bridge of the Newport and Cincinnati Bridge Company across Ohio River between Cincinnati, Ohio, and Newport, Ky.—Plans for reconstructing the bridge at this locality were approved by the Secretary of War March 6, 1893. (See Annual Report, Chief of Engineers, 1893, p. 464.) On April 30, 1895, the Pennsylvania Railroad Company, which controls the bridge, submitted for approval new plans providing for a greater height and length of channel span than that required by the original plans, and to be in lieu thereof. The new plans were approved by the Secretary of War May 21, 1895; copy sent to Lieut. Col. Amos Stickney, Corps of Engineers, May 23, 1895.

17. Bridge of the Lexington Bridge and Terminal Company across Missouri River at Lexington, Mo.—The construction of this bridge was authorized by act of Congress approved July 26, 1894. Plans and map of location were submitted by the company April 9, 1895; approved by the Secretary of War July 9, 1895; copy sent to Lieut. Col. Charles R. Suter, Corps of Engineers, President of the Missouri River Commission, July 10, 1895.

18. Bridge of Dawson County, Mont., across Yellowstone River at Glendive.—The construction of this bridge was authorized by act of Congress approved February 26, 1895. Plans and map of location were submitted May 26, 1895; approved by the Secretary of War July 9, 1895; copy sent to Capt. H. F. Hodges, Corps of Engineers, July 11, 1895.

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19. Bridge of the Jefferson City Bridge and Transit Company across Missouri River at Jefferson City, Mo.—The construction of this bridge was authorized by act of Congress approved May 28, 1894, as amended by act of January 8, 1895. Plans and map of location were submitted by the company May 14, 1895; approved by the Secretary of War July 22, 1895, upon certain conditions for maintenance of a depth of water to and through the drawspans not less at all stages than that which is found in the adjacent improved portions of the river; copy sent to Lieut. Col. Charles R. Suter, Corps of Engineers, President of the Missouri River Commission, September 9, 1895.

20. Bridge of the Kansas City, Pittsburg and Gulf Railroad Company across Arkansas River, near Hicks Rock, Indian Territory.—Under authority of an act of Congress approved February 27, 1893, plans and map of location of this bridge were submitted by the company June 21, 1895. Subsequently modified plans were submitted through the local engineer officer July 22, 1895; approved by the Secretary of War July 29, 1895; copy sent to Lieut. W. L. Sibert, Corps of Engineers, July 31, 1895.

21. Bridge of the St. Lawrence Railway Company across St. Lawrence River at Morristown, N. Y.—Plans for the construction of this bridge were approved by the Secretary of War February 6, 1894. (See Annual Report, Chief of Engineers, 1894, p. 425.) Modified plans providing for a reduction of three of the spans, as originally approved, to two spans of increased length were submitted by the company August 5, 1895; approved by the Secretary of War August 29, 1895; copy sent Capt. Smith S. Leach, Corps of Engineers, August 30, 1895.

Under the provisions of section 7 of river and harbor act approved September 19, 1890, amended by section 3 of river and harbor act approved July 13, 1892, bridges may be built over navigable waters entirely within the limits of any State, under the authority of legislative enactment of such State, when the plans and locations of the structures are approved by the Secretary of War. Plans and locations of the following bridges proposed to be erected under these provisions have been examined, with a view to protection of the interests of navigation, and have been approved by the Secretary of War; and the local engineer officers have been furnished with copies of the drawings and instruments of approval, and charged with the supervision of construction of the bridges so far as necessary to see that they are built in accordance with the approved plans.

1. Bridge of the town of Fort Winnebago, Wis., across Fox River near Governors Bend Lock.—Plans for a bridge to replace the existing structure at this place were submitted August 25, 1894; approved by the Secretary of War September 15, 1894; copy sent to Maj. James F. Gregory, Corps of Engineers, September 18, 1894.

Application was made January 19, 1895, for a modification of the plans with respect to the piling; approved by the Secretary of War February 6, 1895; copy sent to Capt. Carl F. Palfrey, Corps of Engineers, February 8, 1895. The bridge has been completed in accordance with the approved plans.

2. Bridge of the city of Stockton, Cal., across Mormon Channel at Otter street.—Plans and map of location were submitted August 7, 1894; approved by the Secretary of War September 17, 1894; copy sent to Maj. W. H. Heuer, Corps of Engineers, September 19, 1894.

On December 11, 1894, application was made for approval of modified plans providing for a change in the location; approved by the Secretary of War January 7, 1895; copy sent to Major Heuer January 8, 1895. The bridge has been completed in accordance with the approved plans.

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3. Bridge of the Jacksonville, St. Augustine and Indian River Railway Company across St. Johns River at Palatka, Fla.—Plans for rebuilding the existing structure at this place were submitted September 1, 1894, and modified plans September 20, 1894; approved by the Secretary of War October 9, 1894; copy sent to Maj T. H. Handbury, Corps of Engineers, October 9, 1894.

4. Bridge of the Birmingham and Pittsburg Bridge Company across Monongahela River at South Tenth street, Pittsburg, Pa.—Plans for the reconstruction of the existing bridge at this locality were submitted July 20, 1894, but proving unsatisfactory to the navigation interests, modified plans conforming to the requirements of navigation were subsequently presented, which were approved by the Secretary of War October 22, 1894; copy sent to Maj. R. L. Hoxie, Corps of Engineers, October 24, 1894.

5. Bridge of Gallatin and White counties across Little Wabash River at New Haven, Ill.—Plans and map of location were received October 9, 1894; approved by the Secretary of War November 19, 1894; copy sent to Capt. J. G. Warren, Corps of Engineers, November 20, 1894. Application for modification of the approved plan was submitted January 29, 1895; approved by the Secretary of War February 23, 1895; copy sent to Captain Warren February 26, 1895. The bridge has been completed in accordance with the approved plans.

6. Bridge of the street railroad companies of Duluth, Minn., and Superior, Wis., across St. Louis River between Rices and Connors points.—Plans and map of location for a temporary bridge at this place were received November 24, 1894; approved by the Secretary of War December 15, 1894; copy sent to Maj. Clinton B. Sears, Corps of Engineers, December 17, 1894.

7. Bridge of the Wilmington and Weldon Railroad Company across Neuse River, North Carolina.—Plans and map of location were received December 6, 1894; approved by the Secretary of War December 17, 1894; copy sent to Maj. W. S. Stanton, Corps of Engineers, December 19, 1894.

8. Bridge of the city of Philadelphia, Pa., across Frankford Creek at Bridge street.—Plans for the reconstruction of the existing bridge at this place were submitted November 30, 1894; approved by the Secretary of War January 7, 1895; copy sent to Maj. C. W. Raymond, Corps of Engineers, January 9, 1895.

9. Bridge of the Norfolk and Carolina Railroad Company across Scotts Creek in Norfolk County, Va.—Plans and map of location were submitted December 17, 1894; approved by the Secretary of War January 9, 1895; copy sent to Capt. T. L. Casey, Corps of Engineers, January 11, 1895. The bridge has been completed in accordance with the approved plans.

10. Bridge of the city of New York across Harlem River at First avenue.—Plans and map of location were submitted by the Commissioner of Public Works November 19, 1894; approved by the Secretary of War January 11, 1895; copy sent to Lieut. Col. G. L. Gillespie, Corps of Engineers, January 14, 1895.

11. Bridge of the receivers of the Wisconsin Central Railroad Company across Wolf River at Gills Landing, Wis.—Plans and map of location of this bridge were approved by the Secretary of War December 7, 1893. (See Annual Report, Chief of Engineers, 1894, p. 427.) On January 14, 1895, the company made application for modification of the approved plans in respect to the construction of sheer booms according to plans submitted; approved by the Secretary of War

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February 5, 1895; copy sent to Capt. Carl F. Palfrey, Corps of Engineers, February 8, 1895.

12. Bridge of the Chicago and Northwestern Railway Company and the Kewaunee, Green Bay and Western Railroad Company across Fox River between Green Bay and Fort Howard, Wis.—Plans and map of location were submitted January 15, 1895; approved by the Secretary of War February 5, 1895; copy sent to Capt. Carl F. Palfrey, Corps of Engineers, February 9, 1895.

13. Bridge of the city of Providence across Seekonk River, Rhode Island.—Plans for the reconstruction of the central or red bridge at this locality were submitted by the city engineer December 20, 1894; approved by the Secretary of War February 5, 1895; copy sent to Capt. W. H. Bixby, Corps of Engineers, February 6, 1895.

14. Bridge of the Lone Rock Bridge Company across Wisconsin River near Lone Rock, Wis.—Plans and map of location were submitted January 16, 1895; approved by the Secretary of War February 21, 1895; copy sent to Capt. Carl F. Palfrey, Corps of Engineers, February 25, 1895.

15. Bridge of the Silver Springs, Ocala and Gulf Railway Company across Withlacoochee River at Dunnellon, Fla.—Plans and map of location of this bridge were approved by the Secretary of War June 14, 1894. (See Annual Report, Chief of Engineers, 1894, p. 429.) On February 6, 1895, the company applied for permission to make certain changes in construction, indicated on plans submitted; approved by the Secretary of War February 23, 1895; copy sent to Maj. T. H. Handbury, Corps of Engineers, February 26, 1895.

16. Bridge of the Port Bolivar, Galveston and Virginia Point Terminal Railroad Company across Galveston Bay, Texas.—Plans and map of location were submitted January 12, 1895; approved by the Secretary of War March 25, 1895; copy sent to Maj. A. M. Miller, Corps of Engineers, March 27, 1895.

17. Bridge of the New York, New Haven and Hartford Railroad Company across Norwalk Harbor (or river) at South Norwalk, Conn.—Plans and map of location were submitted March 14, 1895; approved by the Secretary of War April 4, 1895; copy sent to Col. H. M. Robert, Corps of Engineers, April 6, 1895.

18. Bridge of the city of Toledo, Ohio, across Maumee River.—Plans and map of location were submitted by the mayor February 4, 1895, and modified plans were received by the Secretary of War March 25, 1895; approved by the Secretary of War April 12, 1895; copy sent to Lieut. Col. Jared A. Smith, Corps of Engineers, April 13, 1895.

19. Bridge of the city of Boston (Chelsea Bridge) across Mystic River, Massachusetts.—Plans for the reconstruction of the drawspan of this bridge were submitted April 16, 1895; approved by the Secretary of War May 4, 1895; copy sent to Lieut. Col. S. M. Mansfield, Corps of Engineers, May 6, 1895.

20. Bridge of the Lynn and Boston Railroad Company across Mystic River, Massachusetts.—Plans for the construction of a temporary bridge at this locality for the accommodation of traffic during the rebuilding of the Chelsea Bridge by the city of Boston (plans for which were approved by the Secretary of War May 4, 1895, see above) were submitted by the company May 8, 1895; approved by the Secretary of War May 21, 1895; copy sent to Lieut. Col. S. M. Mansfield, Corps of Engineers, May 24, 1895.

21. Bridge of the Central Pacific Railroad Company across San Joaquin River, California.—Plans for the reconstruction of the existing bridge

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at this locality were submitted by the company April 19, 1895, and modified plans May 7, 1895; approved by the Secretary of War May 21, 1895; copy sent to Maj. W. H. Heuer, Corps of Engineers, May 24, 1895.

22. Bridge of the Richmond, Fredericksburg and Potomac Railroad Company across Aquia Creek, Virginia.—Plans for reconstructing the draw in the existing bridge were submitted by the company May 24, 1895. The plans were approved by the Secretary of War June 6, 1895, including permission for the erection of temporary structures in the creek, closing the draw to navigation for a period not exceeding three weeks; copy sent to Maj. Chas. E. L. B. Davis, Corps of Engineers, June 8, 1895.

23. Bridge of the St. Augustine Bridge Company across Matanzas River at St. Augustine, Fla.—Plans and map of location were submitted May 20, 1895; approved by the Secretary of War June 10, 1895; copy sent to Maj. T. H. Handbury, Corps of Engineers, June 12, 1895.

24. Bridge of the California Pacific Railroad Company across Sacramento River at Sacramento, Cal.—Plans for a bridge to replace the existing structure at this place were submitted April 18, 1895; approved by the Secretary of War June 11, 1895; copy sent to Maj. W. H. Heuer, Corps of Engineers, June 14, 1895.

25. Bridge of the city of Chicago, Ill., across North Branch of Chicago River at Fullerton avenue.—Plans for construction of a bridge to replace the existing structure were submitted May 25, 1895; approved by the Secretary of War June 19, 1895; copy sent to Maj. W. L. Marshall, Corps of Engineers, July 6, 1895.

26. Bridge of the Tennessee Central Railroad Company across Clinch River in Roane County, Tenn.—Plans and map of location were submitted May 27, 1895; approved by the Secretary of War June 20, 1895; copy sent to Capt. T. A. Bingham, Corps of Engineers, June 22, 1895.

27. Bridge of the city of Tampa, Fla., across Hillsboro River.—Plans for rebuilding the existing bridge at this place were submitted June 5, 1895; approved by the Secretary of War June 22, 1895; copy sent to Maj. T. H. Handbury, Corps of Engineers, June 25, 1895.

28. Bridge of the city of Chicago, Ill., across North Branch of Chicago River at Diversey avenue.—Plans and map of location were submitted June 4, 1895; approved by the Secretary of War June 22, 1895; copy sent to Maj. W. L. Marshall, Corps of Engineers, July 6, 1895.

29. Bridge of Burlington County, N. J., across South (Lumberton) Branch of Rancocas River at Hainesport.—Plans for a bridge to replace the existing structure at this place were submitted May 24, 1895, and modified plans June 22, 1895; approved by the Secretary of War July 10, 1895; copy sent to Maj. C. W. Raymond, Corps of Engineers, July 12, 1895.

30. Bridge of the Ocean Causeway Company across Rockaway Inlet (Far Rockaway Bay) between Hicks Beach and Shelter Island, New York.—Plans and map of location were received August 15, 1894, and modified plans May 9, 1895; approved by the Secretary of War July 16, 1895; copy sent to Lieut. Col. G. L. Gillespie, Corps of Engineers, July 19, 1895.

31. Bridge of the Jacksonville, St. Augustine, and Indian River Railroad Company across Lake Worth at Palm Beach, Fla.—Plans and map of location were submitted by the company June 25, 1895; approved by the Secretary of War July 19, 1895; copy sent to Lieut. A. M. D'Armit, Corps of Engineers, July 22, 1895.

32. Bridge of the Fifth Avenue and High Street Bridge Company across Youghiogheny River at Fifth avenue, McKeesport, Pa.—Plans and map

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of location were submitted June 26, 1895; approved by the Secretary of War July 31, 1895; copy sent to Maj. R. L. Hoxie, Corps of Engineers, August 2, 1895.

33. Bridges of the Manitowoc Terminal Company across Manitowoc River at Manitowoc, Wis. —Plans and maps of locations of bridges at Main street and at Eighth street were submitted by the company July 22, 1895; approved by the Secretary of War August 2, 1895; copy sent to Capt. Carl F. Palfrey, Corps of Engineers, August 3, 1895.

34. Bridge of Springwells and Ecorse townships, Wayne County, Mich., across Rouge River at the river road crossing.—Plans and map of location were submitted August 12, 1895; approved by the Secretary of War August 27, 1895, upon condition requiring the dredging of a channel through one of the draw passages to communicate with the river channel above and below; copy sent to Lieut. Col. G. J. Lydecker, Corps of Engineers, August 29, 1895.

35. Bridge of the Middletown and Portland Bridge Company across Connecticut River between Middletown and Portland, Conn.—Plans and map of location were submitted by the company July 3, 1895; approved by the Secretary of War August 6, 1895; copy sent to Col. H. M. Robert, Corps of Engineers, August 8, 1895. Subsequently, August 20, 1895, the company requested that the condition respecting riprap around the piers on both sides of each drawspan be modified according to plans submitted; approved by the Secretary of War August 28, 1895; copy sent to Colonel Robert August 30, 1895.

Under the provisions of sections 4 and 5 of the river and harbor act approved September 19, 1890, relating to bridges obstructing navigation, plans for alteration of the following bridges so as to render navigation unobstructed have been examined and approved by the Secretary of War; and the local engineer officers have been furnished with copies of the plans and instruments of approval and charged with supervision of the work of alteration so far as necessary to see that the approved plans are complied with:

1. Bridge of the Central Bridge Company across Saginaw River at Bristol street, Saginaw, Mich.—This bridge was damaged by a cyclone in September, 1894, and repaired by the company without lawful authority. Complaint was made that the bridge as repaired was an obstruction to navigation, and the company, September 26, 1894, requested that the constructions (shown on drawing submitted November 5, 1894) be permitted to remain temporarily. These constructions were approved by the Secretary of War November 16, 1894, upon condition that everything of an obstructive character be removed by the opening of spring navigation, and that the bridge be reconstructed by that time in accordance with plans to be approved by the Secretary of War; copy sent to Lieut. Col. G. J. Lydecker, Corps of Engineers, November 19, 1894.

2. Bridge of the State of Connecticut across Connecticut River between Hartford and East Hartford.—Complaint having been made that this bridge was an obstruction to navigation proceedings were instituted against it, and, January 8, 1895, notices of the Secretary of War of October 1, 1894, were served on the State commissioners on the Hartford Bridge, requiring a change in the location of the drawspan and an increase of width of the draw opening to at least 100 feet in the clear. Plans conforming to these requirements were received from the commissioners December 7, 1894; approved by the Secretary of War December 28, 1894; copy sent to Col. H. M. Robert, Corps of Engineers, December 31, 1894.

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3. Bridge of the Paragould Southeastern Railroad Company across St. Francis River below Kennett, Mo.—Complaint having been made that this company had constructed, without lawful authority, a pile bridge at this locality which was an unreasonable obstruction to navigation, the Attorney-General was requested January 16, 1895, to cause proper proceedings to be commenced against the company under section 10 of the act of Congress approved September 19, 1890. As a result of this action plans were subsequently submitted for a draw proposed to be placed in the bridge, and these plans proving satisfactory to the navigation interests were approved by the Secretary of War March 26, 1895; copy sent to Lieut. W. L. Sibert, Corps of Engineers, April 16, 1895.

4. Bridges of Kings and Queens counties across Newtown Creek between Long Island City and Brooklyn, N. Y.—Complaint having been made against the existing bridge at Manhattan avenue, and proceedings having been instituted against it, plans for a new structure conforming to the requirements of the Department were submitted by the supervisors of Kings and Queens counties. These plans, together with plans for a temporary bridge, were approved by the Secretary of War May 7, 1895, and a copy was sent to Lieut. Col. G. L. Gillespie, Corps of Engineers, May 8, 1895.

5. Bridge of the Baltimore and Ohio Southwestern Railway Company across Muskingum River at Marietta, Ohio.—On December 14, 1889, the engineer officer in local charge of the improvement of Muskingum River reported that this bridge would become an obstruction to navigation upon completion of the ice-harbor lock at Marietta, and proceedings against the company were begun under the provisions of the act of Congress of August 11, 1888, and notices of the Secretary of War requiring the bridge to be provided with a suitable draw opening, to be completed by December 1, 1890, served on the company August 27, 1890. The law under which notice was served having been modified by the river and harbor act of September 19, 1890, and the railroad company having failed to comply with the requirements of the notice, the matter was investigated under the act of 1890 by Lieut. Col. William E. Merrill, Corps of Engineers, and upon his recommendation new notice, dated January 22, 1891, requiring the alterations specified to be completed by October 31, 1891, was served on the railroad company January 24, 1891. Subsequently the time in which to complete the work was extended to July 1, 1892, and February 6, 1893, the order directing the alterations to be made was revoked by the Secretary of War.

The river and harbor act of August 17, 1894, in making appropriation for completing the ice harbor at the mouth of Muskingum River authorizes and directs the Secretary of War to require the necessary changes to be made in the bridge of the Baltimore and Ohio Southwestern Railway Company, at Marietta, Ohio, necessary to make said bridge conform to and accommodate the commerce of said river and to the improvements made therein by the United States, and to use for that purpose so much of the funds for the care and maintenance of public works as may be necessary to complete and perfect such changes, requiring that the managers of the railway line aforesaid shall construct the superstructure of the draw in said bridge, under the supervision and to the satisfaction of the Secretary of War, and maintain the same in good order to protect the navigation of said river; and in compliance with this law Lieut. Col. Amos Stickney, Corps of Engineers, December 27, 1894, submitted plans for the construction of a

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pivot pier for this bridge, with guard, at an estimated cost of $10,449.60. These plans and estimate were approved by the Secretary of War June 4, 1895, and Lieutenant Colonel Stickney was advised June 4, 1895.

6. Bridge of Muskingum County, Ohio, across Muskingum River at Taylorsville, Ohio.—On January 10, 1890, the local engineer officer reported that this bridge would become an obstruction to navigation upon completion of Lock No. 9 at Taylorsville, and proceedings were instituted against the commissioners of Muskingum County under the provisions of the act of Congress of August 11, 1888. Notice of the Secretary of War dated August 8, 1890, was served upon the commissioners to alter the bridge so as to render navigation through it reasonably free, easy, and unobstructed, by providing it with a suitable draw span. The authorities of the bridge having taken no action toward compliance with the terms of the notice, the matter was again investigated under the provisions of the act of September 19, 1890, and in accordance with recommendation of Lieut. Col. William E. Merrill, Corps of Engineers, new notice, dated February 25, 1891, requiring the necessary alterations to be made by September 30, 1891, was served on the bridge authorities March 3, 1891. The requirements of this notice were not complied with and legal proceedings were instituted against the commissioners of Muskingum County by the Department of Justice. This suit resulted in a verdict for defendant in a decision rendered by Judge George R. Sage, of the United States district court, southern district of Ohio, eastern division, May 14, 1892. (Printed in Annual Report, Chief of Engineers, 1892, pages 2004–2006.)

The river and harbor act of August 17, 1894, in making appropriation for the completion of the lock machinery at Taylorsville, authorizes and directs the Secretary of War to require the necessary changes to be made in the county bridge at Taylorsville, Ohio, necessary to make said bridge conform to and accommodate the commerce of said river and to the improvements made therein by the United States, and to use for that purpose so much of the funds for the care and maintenance of public works as may be necessary to complete and perfect such changes, requiring that the county commissioners of Muskingum County shall construct the superstructure of the draw in said bridge, under the supervision and to the satisfaction of the Secretary of War, and to maintain the same in good order to protect the navigation of said river.

Accordingly, June 8, 1895, Lieut. Col. Amos Stickney, Corps of Engineers, submitted plans for the construction of pivot pier and guide cribs for this bridge, at an estimated cost of $5,834.20. These plans and estimate were approved by the Secretary of War June 12, 1895, and Lieutenant-Colonel Stickney was advised June 13, 1895.

BRIDGES OBSTRUCTING NAVIGATION

Under the requirements of sections 4 and 5 of the river and harbor act approved September 19, 1890, the Secretary of War notified the persons, corporations, or associations owning or controlling certain bridges obstructing navigation, after giving them a reasonable opportunity to be heard, to so alter said bridges as to render navigation through or under them reasonably free, easy, and unobstructed, specifying in the notice the alterations required to be made, and prescribing a reasonable time in which to make them, as follows:

1. Highway ("Tukey's") bridge across the entrance to Back Cove, Portland Harbor, Maine.—Notice dated August 13, 1894, served on the mayor of the city of Portland, Me., August 16, 1894. Alteration required: The construction of a swing draw having a clear opening of not less than 50 feet, with the piers on the upstream and downstream

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sides strengthened and planked and suitable clumps of piles to strengthen and protect the south side of the draw opening. Alteration to be made and completed on or before December 31, 1894. Time extended to December 31, 1895, and subsequently to December 31, 1896, for the reason that the construction of a new draw at the present time would seriously interfere with the work of dredging the Back Cove channel.

2. Highway bridge across the Connecticut River between Hartford and East Hartford, Conn.—Notice dated December 28, 1894, served on the State commissioners on the Hartford Bridge January 8, 1895. Alteration required: The construction of a draw having a span of at least 100 feet width of opening in the clear, to be located where at present is the third span from the Hartford shore. Alteration to be made and completed on or before October 1, 1895.

3. Highway bridge across the Warrior River between Tuscaloosa and Northport, Ala.—Notice dated March 6, 1895, served on the judge of probate and principal judge of the court of county commissioners of the county of Tuscaloosa, State of Alabama, March 13, 1895. Alteration required: A draw to be placed in said bridge between Pier No. 1 and Pier No. 2, as designated on attached drawing, so as to give a clear opening of 90 feet. Alteration to be made and completed on or before December 1, 1895.

4. Highway bridge across the Quinnipiac River at Grand avenue crossing, New Haven, Conn.—Notices dated April 8, 1895, served on the clerk of the city of New Haven, and on the town clerk of the town of New Haven, respectively, April 13, 1895. Alteration required: The bridge to be provided with a drawspan having a width of opening of at least 70 feet in the clear, measured at right angles to the channel. Alteration to be made and completed on or before December 31, 1896.

5. Highway bridge over Tar River at Tarboro, and the highway bridge known as Bells Bridge over said river about 13 miles above Tarboro, N. C.—Notice dated August 7, 1895, served on the chairman of the county commissioners of the county of Edgecombe, State of North Carolina, August 12, 1895. Alteration required: Each of said bridges to be provided with a drawspan having clear openings each 30 feet wide, said spans to be placed over the middle channel, the opening to be parallel with the direction of the current, and the draws to be provided with such mechanism as will enable them to be opened easily and quickly. Alteration to be made and completed on or before February 1, 1896.

6. Railroad bridge over Flushing Creek, New York, near the Bridge street station on the Whitestone branch of the Long Island Railroad.—Notice dated August 9, 1895, served on the president of the Long Island Railroad Company August 15, 1895. Alteration required: To be provided with a straight channel practically in the direction of the axis of the stream, with a clear width of at least 40 feet in the draw and between the guard piling. Alteration to be made and completed on or before March 1, 1896.

OCCUPANCY OF AND INJURY TO PUBLIC WORKS BY CORPORATIONS AND INDIVIDUALS.

Under the requirements of section 2 of the river and harbor act approved July 5, 1884, and section 4 of the river and harbor act approved August 5, 1886, there are submitted herewith reports of officers in charge of river and harbor districts of instances in which piers, breakwaters, or other works built by the United States in aid of commerce or navigation are used, occupied, or injured by corporations or individuals. (See Appendix Z Z.)

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MISCELLANEOUS.

[Public works not provided for in acts making appropriations for the construction, repair, and preservation of works on rivers and harbors.]

REPAIR OF THE AQUEDUCT BRIDGE ACROSS POTOMAC RIVER, AT WASHINGTON, D. C.

This work was in the charge of Maj. Chas. E. L. B. Davis, Corps of Engineers.

In accordance with a resolution of the United States Senate of January 21, 1893, an examination of the piers and abutments of the Aqueduct Bridge over the Potomac River at Georgetown, D. C., was made by a diver and a report of the result of this examination submitted by the officer in charge June 21, 1893, and an estimate of cost July 17, 1893.

Congress, by act of August 7, 1894, in the District of Columbia appropriation act for the fiscal year ending June 30, 1895, appropriated the estimated amount, $51,070, for the repairs to the bridge, to be done under the direction of the Chief of Engineers, by contract or otherwise, and by the purchase of material in open market, in order to prevent delay in the prosecution of the work.

In the approved project it was proposed to repair all of the eroded piers, six in number, by means of concrete in bags put in place by a diver, except pier No. 4, which was so badly eroded that a cofferdam was considered necessary. It was proposed to build this cofferdam on substantially the plan used originally by Major Turnbull in 1838, but it was found that a large and expensive plant would have to be procured, which would consume considerable time, so correspondence was opened with firms engaged in the class of work. Five firms were written to and two firms made tenders, and that of the lowest, Shailer & Schniglau, of Chicago, Ill., for $33,765, was accepted. This firm was to build a heavily timbered, stone-filled water-tight crib surrounding the entire pier. The ends of the trusses resting on the pier were to be supported by trestlework so as to take the weight off of the pier during the repairs. Before pumping out the dam the overhanging masonry of the ice breaker was to be shored up by a diver to prevent any risk of its falling when the buoyant effort of the water was removed. The dam being pumped out and kept dry, the defective masonry was to be removed and replaced by new.

There were many difficulties attending the prosecution of this work, with one serious break in the cofferdam, accounts of which are given in considerable detail in the report of the local officer. The pier was supposed to have been constructed of substantial masonry laid on the bed rock of the river, but as the work of pumping out and removing the silt and débris progressed it was found that the old masonry had not been started from solid rock but upon riprap stone apparently thrown in without removing the débris from the rock. Layers of mud and sand were found under the lowest of the old shores, while lying on the rock diagonally under the masonry of the pier an old tree was found which must have been there before the pier was built. For about 12 feet above this insecure foundation the masonry is of the poorest possible quality, the stones being apparently put in as they came from the quarry without the slightest reference to beds, being set on end, edge, and in every conceivable manner, while few if any traces of mortar or cementing material were found. Approaching the low-tide level the quality of the masonry improves, and from about 6 feet below low

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tide up to the top of the pier the masonry, while rough in appearance, is fairly good rubble masonry.

At the close of the fiscal year ending June 30, 1895, the repairs to Piers Nos. 2, 3, 5, 6, 7, and 8, by means of concrete in bags put in place by a diver, had been completed. The cofferdam around Pier No. 4 had been completed and pumped out, an inner dam, rendered necessary by the existence of springs of clear water coming through fissures in the rock bed of the river, was built and pumped out so as to get a secure foundation for the new masonry, this auxiliary dam reaching to a level 6 feet below that drained by the large pump of the main dam. The lowest level of the bed rock reached was 31 feet below low tide, and had probably never before been exposed. The bed rock was found to be very irregular and covered with small projecting spurs or nodules with depressions and hollows. The general level of the rock plateau uncovered was 24 feet below low tide. This plateau will be leveled up by breaking off the nodules and filling depressions with concrete, and the masonry started thereon.

It is expected that the repairs will be completed, as far as can be done under the present contract, soon after the close of the fiscal year, when the dam will be filled and made ready to resist ice and freshets.

An estimate of cost for completely repairing this pier will be made, and Congress asked to appropriate the necessary money.

Amount appropriated by District of Columbia appropriation act of August 7, 1894		$51,070.00
June 30, 1895, amount expended during fiscal year		27,282.03
July 1, 1895, balance unexpended		23,787.97
July 1, 1895, outstanding liabilities	$457.00	
July 1, 1895, amount covered by uncompleted contracts	15,590.00	
		16,047.00
July 1, 1895, balance available		7,740.97

(See Appendix A A A.)

MAINTENANCE AND REPAIR OF WASHINGTON AQUEDUCT—INCREASING THE WATER SUPPLY OF WASHINGTON, D. C.—ERECTION OF FISHWAYS AT THE GREAT FALLS OF THE POTOMAC RIVER.

Officers in charge, Col. George H. Elliot, Corps of Engineers, until March 30, 1895, when, by operation of law, he was relieved of all works except that of improving the Dalecarlia Reservoir; the remaining works were on that date transferred to Maj. John G. D. Knight, Corps of Engineers, the officer now in charge.

1. Washington Aqueduct.—About 1,900 feet below the Great Falls gatehouse is wasteweir No. 1. The masonry at its outlet had never been completed and water would flow freely from this outlet at reference 150, or 1 foot below the top of the soffit of the conduit, while in times of freshets driftwood could enter the conduit. The masonry work has been completed and provision has been made for stop planks by which the level of the water can be held at reference 151, which will be the level of the water on the dam at low stages of the river, when the dam is raised as is now proposed, and gratings have been placed to prevent the indraft of logs even should a freshet 3 feet higher than that of 1889 occur.

The appropriation for this work was $5,000; its cost $3,042.41.

A drain 820 feet long was laid from the valve chamber at the distributing reservoir to the Chesapeake and Ohio Canal.

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The reference of the flow line of this reservoir is 146 feet above datum; during the year the level of the water in the reservoir fluctuated between references 141.45 and 145.55, and reached a level of 144.40, or above, each month. Any material reduction of head in the city service below the level of such service in 1890, when the 48-inch main was put in use, is not therefore to be attributed to low levels of water in the reservoir. Raising the height of the dam at Great Falls is but a partial provision for an increased consumption. Additional means of bringing the water from the distributing reservoir to the consumer must speedily be provided.

Extensive repairs have been made to the Conduit road and casings of 24 manholes along the conduit raised, having been found to be below the hydraulic grade line.

An appropriation of $14,000 has been made for removing the accumulation of deposits in the conduit. This work is to be attempted by loosening the deposits with hoes and shovels and sluicing out the loosened material; consequently it can only be carried on when the river is high and for not more than twenty-four hours at a time without materially affecting the water service. The work has been carried on, but not completed, over about 8,700 feet of main and by-conduit. Ordinarily, deposits are from 8 to 10 inches in depth.

Section 1803, Revised Statutes, forbids the tapping of any main laid by the United States in the District of Columbia except by permission of the Chief of Engineers, U. S. Army. With the approval of the Secretary of War, general authority has been granted to the Commissioners of the District of Columbia to tap all United States mains of 12 inches in diameter, or less, with the exception of parts of the 10-inch and 12-inch mains. Permission to tap the 30-inch main for service connections not exceeding 1 inch in diameter has been given in four cases.

Griffiths Park and Cabin John bridges have been repaved with vitrified bricks at a cost of $2,834.98. Five thousand dollars was appropriated for this work.

Repairs have been made to the wooden bridges and lumber has been purchased for extensive repairs to the bridge across the spillway of the Dalecarlia Reservoir and for reflooring the bridge across Rock Creek. This latter bridge needs reflooring every three years, whether with oak or Georgia pine.

Complete reports have been made on encroachments on aqueduct lands. Under authority of law a small tract has been sold; a revocable license to maintain a house partly on such land has been given in one case and in two notices to remove sheds and barns within one year have been served. Owners of encroaching fences will be notified that when these fences are rebuilt they must not encroach on United States lands. Two buildings belonging to private parties have been removed by them from these lands.

The daily consumption and waste of water was measured June 25, 1895, and determined to be 47,182,681 gallons. Based upon the population, as enumerated by the police June, 1892, and December, 1894, this corresponds to a per capita daily consumption of 170 gallons, or 18 gallons less than the consumption as determined June 28, 1894.

Estimates submitted in previous years are renewed, for protecting the inlet to the aqueduct at Great Falls; for purchase or condemnation of a site for a storage yard, and for inserting air valves and blow-off valves in the 36-inch and 30-inch mains.

Full explanations of these, all of which have my approval, are given in the report of the officer in charge. This officer also recommends an

increase of $1,000 in the annual appropriation for the maintenance and repair of the aqueduct, and gives reasons therefor.

Washington Aqueduct.

July 1, 1894, balance unexpended		$0.41
Amounts appropriated by act approved—		
August 7, 1894, for maintenance and repairs	$20,000.00	
August 7, 1894, for repair of bridges	5,000 00	
August 7, 1894, for protecting conduit	5,000.00	
March 2, 1895, for removing deposits	14,000.00	
		44,000.00
		44,000.41
January 10, 1895, amount deposited in Treasury, being balance of appropriation of 1894	.41	
June 30, 1895, amount expended during fiscal year	21,008.51	
		21,008.92
July 1, 1895, balance unexpended		22,991.49
July 1, 1895, outstanding liabilities		3,307.25
July 1, 1895, balance available		19,684.24
Amount that can be profitably expended in fiscal year ending June 30, 1897		21,000.00

The estimates of the officer in charge for the fiscal year ending June 30, 1897, are as follows:

For protecting the inlet to the aqueduct at Great Falls	$5,000
For purchase or condemnation of a site for a storage yard	10,000
For inserting air valves and blow-off valves in the 36-inch and 30-inch mains	6,250
For maintenance and repair of the aqueduct and the reservoirs, mains, roads, etc., connected therewith	21,000
	42,250

(See Appendix B B B 1.)

2. Increasing the water supply of Washington, D. C.—All operations on this project are suspended. A watchman has been employed during the year at the new reservoir, whose duties include guarding the stone at the mouths of all the shafts except the one at Foundry Branch, which is under the care of the watchman at the distributing reservoir.

Of the available balance of the appropriations for this work $125,000 was by act of Congress approved March 2, 1895, made applicable,

For raising the height of the dam at Great Falls and other works rendered necessary by the raising of the dam.

The dam is to be raised 2.5 feet, and when raised will cause the river at its low-water stage to practically fill the mouth of the conduit.

Stone is being taken from the Government quarries at Seneca, cut, and stored on the Maryland shore of the Potomac near the point of transfer to the dam. Surveys are being made to determine if any damage to property is to be expected from the increased backwater of the raised dam.

It is expected to complete this work during the low-water stages of this and the next calendar years.

Amount made available by act of March 2, 1895	$125,000.00
June 30, 1895, amount expended during fiscal year	4,006.20
July 1, 1895, balance unexpended	120,993.80
July 1, 1895, outstanding liabilities	3,155.68
July 1, 1895, balance available	117,838.12

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For testing the tunnel conduit the sum of $25,000 was also made applicable from the available balance of the appropriation for increasing the water supply.

The object of this test is to determine the amount of leakage occurring when the tunnel is filled as in service connections.

There are five shafts connected with this tunnel, and during the test the end shafts will be open and the three intermediate shafts closed by masonry. To effect these closures, as well as to note the present condition of the incomplete masonry work of the tunnel, it was necessary to empty the tunnel of about 9,500,000 gallons of seepage water.

All shafts and connecting headings, except the east shaft and its heading, have been pumped out. The masonry work of the three shafts is well advanced, that at Rock Creek shaft being completed.

Tests of the water taken from the tunnel have been made from time to time by officials of the district, and measures have been made to determine the rate of seepage.

Amount made available by act of March 2, 1895	$25,000.00
June 30, 1895, amount expended during fiscal year	8,409.06
July 1, 1895, balance unexpended	16,590.94
July 1, 1895, outstanding liabilities	4,812.79
July 1, 1895, balance available	11,778.15

For report upon completing the tunnel conduit, the sum of $10,000 was made applicable by the act already referred to.

The report, to be submitted to Congress December 2, 1895, is under study.

Amount made available by act of March 2, 1895	$10,000.00
July 1, 1895, balance available	10,000.00

July 1, 1894, balance unexpended and available	427,639.25
June 30, 1895, amount expended and liabilities incurred during the fiscal year	20,864.48
July 1, 1895, balance unexpended and available	406,774.77

No estimate for further appropriation is submitted.

(See Appendix B B B 2.)

Under existing laws, the Chief of Engineers, U. S. Army, has the immediate superintendence of the Washington Aqueduct and of everything connected with the same belonging to the United States. (Sec. 1800, Revised Statutes.) His authority is required to tap all water pipes laid by the United States. (Sec. 1803, Revised Statutes.) He is in no way responsible to the authorities of the District of Columbia though the estimates relating to the maintenance and operation of the aqueduct are required by law to be submitted to the Secretary of the Treasury by the Commissioners of the District. The responsibility fo the care, storage and distribution of the water supply of the District lies severally upon the Chief of Engineers and the District Commissioners. It would seem proper that all the responsibility of operating the complete system of water supply should rest with the officials of the District alone; and that when the work of constructing additional parts of the system is assigned to the Chief of Engineers, under the War Department, the additional structure, when completed, should be turned over to the District authorities to operate.

The modifications of sections 1800, 1803 and 1810 of the Revised Statutes, in accordance with the above views, and the extension of the

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authority of the Commissioners of the District over all completed structures pertaining to the water supply, whether within or without the limits of the District, are recommended.

3. Erection of fishways at Great Falls.—Under a ruling concerning the act of July 15, 1882, providing for the construction of these fishways, the Secretary of War decided that the Engineer officer in charge should be held responsible only for the proper protection of the aqueduct dam at Great Falls and the disbursement of the funds appropriated, the Commissioner of Fish and Fisheries being responsible under the act for the plans and specifications of the fishways and their execution. No work has been done on the fishways during the last fiscal year for want of funds. Property pertaining to this work was removed from a temporary storehouse at Great Falls to the brick storehouse at the distributing reservoir. Sections 2, 3, 4, 5, and 6 and a portion of the permanent dam have been completed. There remains to be constructed the remainder of this dam and section 1. The Commissioner of Fish and Fisheries is of the opinion that an additional sum of $7,890 will be required to complete the work.

July 1, 1894, balance unexpended	$32.02
June 30, 1895, amount expended during fiscal year	23.03
July 1, 1895, balance unexpended	8.99
July 1, 1895, outstanding liabilities	2.93
July 1, 1895, balance available	6.06
Amount deemed necessary by the Commissioner of Fish and Fisheries for the completion of the work	7,890.00

(See Appendix B B B 3.)

IMPROVEMENT OF THE DALECARLIA RECEIVING RESERVOIR.

Officer in charge, Col. George H. Elliot, Corps of Engineers (retired).

This reservoir, lying partly in Montgomery County, Md., and partly in the District of Columbia, constructed for the storage of Potomac water from Great Falls, was contaminated by the water flowing into it from its watershed of about 4,000 acres.

The object of the improvement was the diversion from the reservoir of the latter water, which entered the reservoir by three streams, viz, East Creek, Mill Creek, and Little Falls Branch, and also flowed directly into the reservoir from the hillsides between these streams.

The project for the improvement provided for the erection of dams across the valleys of all of these streams just above their mouths and taking the water of East Creek (the stream farthest to the east that polluted the reservoir) from behind its dam and conducting it by an open channel around the margin of the reservoir, together with the water flowing directly into the reservoir from the hillsides between East Creek and Mill Creek into Mill Creek above its dam. The combined waters of both streams and the water falling directly into the reservoir from the hillsides between Mill Creek and Little Falls Branch were to be carried by a proportionally larger channel, still following the margin of the reservoir, and a short tunnel into the Little Falls Branch. Finally the water of the entire watershed thus collected was to be turned into a shaft to be excavated in the valley of the latter stream above its dam, and from the bottom of this shaft a tunnel about 1,000 feet long, to be excavated under Dalecarlia Hill and under Washington Aqueduct Tunnel No. 4, was to carry the water to a natural water course below the reservoir, in which it would flow off into the Potomac.

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The estimated cost of the work was $150,000.

A map of the watershed and plans of the works may be found in the Report of the Chief of Engineers for 1893, pages 4308–4309.

The work was commenced in July, 1893, and at the beginning of the last fiscal year $58,961.95 had been expended and the tunnel under Dalecarlia Hill and the shaft in the valley of Little Falls Branch had been essentially completed.

Since the beginning of the last fiscal year the work has been actively continued with as large a force as could be worked to advantage, and averaging for a considerable portion of the time from 150 to 250 men.

The amount expended during the last fiscal year, including outstanding liabilities, was $65,720.98.

In addition to other works, the work done since the last fiscal year, which will be found fully described in the report of the officer in charge, included the excavation and lining of the tunnel 400 feet long through the hill east of Little Falls Branch; the construction of heavy retaining walls at the portals of this tunnel and on the hill side of the shaft in the valley of Little Falls Branch; the construction and paving of the open channels, about 1 mile long, around the reservoir; the construction of the earthen dams across the mouths of Little Falls Branch, Mill Creek, and East Creek, these dams aggregating 629 feet in length, and the driving of sheet piles for 491 feet of piling on the sites of the Little Falls Branch and Mill Creek dams; facing with stone the portions of the Mill Creek dam exposed to wind waves; the construction of two wagon bridges, made necessary by the change in the courses of Mill Creek and East Creek; the construction of about 2 miles of strong wire fence for the purpose of excluding animals from the slopes of the open channels and the dams, which have been covered with soil and planted with grass seed; the deepening of the reservoir at its head, and the reexcavation of the old channel from the "North Connection" into the reservoir through which the reservoir was formerly supplied with Potomac water from Great Falls, and which had become entirely filled up with detritus brought down Little Falls Branch in floods since the use of the reservoir was suspended in 1888.

The object of the work, viz, the diversion of the water of the entire watershed, except some small areas under the control of the United States, had at the date of the officer's report been fully completed, the reservoir had been emptied of its contents, and they were being replaced with Potomac water from Great Falls as rapidly as the supply by the Aqueduct in excess of the daily requirements of the city would permit.

At that date (August 1) there remained to be done a considerable amount of work that could not be done before the completion of the diverson of the water and which the running of the water in its new channels and to the shaft in the valley of Little Falls Branch would not interfere with.

About 90 men were still employed on this work and the officer in charge expected that the entire project, with the possible exception of the completion of proceedings in condemnation of certain tracts of land, would be fully completed in a month or six weeks from the date of his report, or before September 15.

July 1, 1894, balance unexpended	$1,038.05	
Amount appropriated by act of August 7, 1894	52,500.00	
Amounted appropriated by act of March 2, 1895	37,500.00	
		$91,038.05
June 30, 1895, amount expended during fiscal year	58,831.36	
July 1, 1895, outstanding liabilities	6,889.62	
		65,720.98
July 1, 1895, balance available		25,317.07

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No further appropriation is required for the work. In the judgment of the officer in charge the money available at the date of his report was abundantly sufficient for the completion of the work, and he expected that there would remain a considerable sum to be covered into the Treasury.

(See Appendix C C C.)

IMPROVEMENT AND CARE OF PUBLIC BUILDINGS AND GROUNDS, AND CARE AND MAINTENANCE OF THE WASHINGTON MONUMENT, IN THE DISTRICT OF COLUMBIA.

Officer in charge, Col. John M. Wilson, Corps of Engineers, with Second Lieut. John S. Sewell, Corps of Engineers, under his immediate orders.

Monthly inspections have been made of the various buildings occupied by the War Department, except the State, War, and Navy building, in connection with their care, repair, and safety.

The work of strengthening and repairing Ford's Theater building, under the terms of the act of Congress approved March 12, 1894, has been completed.

Under the terms of the act of Congress approved August 18, 1894, additional fire escapes have been placed upon the Government Printing Office, the southwest section of the Printing Office raised one story, and a new 5-story structure erected between the southwest and south center sections of the main building.

Under the terms of the act of Congress approved March 2, 1895, plans have been prepared for the erection, upon the site of the Government Printing Office stables, of a 6-story modern fire-proof building, about 102 feet high and covering an area of 175 feet by 30 feet.

The necessary excavations have been made and the foundation for the building is well advanced; contracts have been made for the steel frame and other materials necessary for the prompt erection of the proposed structure.

The Executive Mansion has received the usual care, and such improvements have been made as the funds available would admit; the building has been repainted inside and outside.

New furniture, matting, carpets, curtains, etc., have been supplied from time to time when necessary.

The conservatory and greenhouses were all overhauled and repairs of various kinds made.

Every effort has been made to maintain the Washington Monument and its machinery in good condition, and to continue the improvement and ornamentation of the adjacent grounds.

All boilers and machinery have been carefully overhauled and cleaned, and the work of repainting the ironwork of the interior of the monument has been continued.

The steam pipes in the tunnel have been incased in magnesia covering.

The boiler house, engine room, and elevator car have been connected by telephone.

The elevator receives the most careful attention, being constantly inspected by experts, and it is believed to be as safe as it is in the power of man to make it.

There were 159,707 visitors to the top of the shaft during the year, making a total of 1,098,126 persons who have made the ascent since the monument was opened to the public in October, 1888.

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The improvement of the Monument Grounds has been continued, plank walks constructed, new water pipe introduced, flower beds planted, etc.

At the propagating gardens and nurseries, extensive repairs were made to the greenhouses, about 380,000 plants propagated for use in the public parks, shops and storehouses repaired, a new greenhouse, hot frame and potting shed constructed, new roads and walks laid out, a new tank for growing water lilies, etc., built and a number of trees and shrubs planted.

The asphalt roads and walks in Smithsonian, Judiciary, and Lincoln parks have been extended, a section of asphalt roadway laid in south grounds of Executive Mansion and a stone flagging walk laid in Seaton Park from Third to Seventh street.

Repairs have been made to asphalt walks in Lafayette Park, Franklin Park, and some of the smaller improved reservations.

A new granolithic pavement has been laid in the grounds north of the Executive Mansion.

The officer in charge invites attention to the propriety of erecting a separate building for office purposes for the President of the United States.

He also recommends the extension of the electric-light system to include the Monument Grounds, Lafayette and Franklin parks, the improvement of several reservations, and the construction of an asphalt walk on the border of the ellipse south of the Executive Mansion.

Attention is invited to the detailed report of the officer in charge, and to his estimates and recommendations for the fiscal year ending June 30, 1897.

His estimates are as follows:

For improvement and care of public buildings and grounds in charge of the Chief of Engineers		$142,449.70
For compensation of persons employed on public buildings and grounds		52,500.00
For replacing old telegraph poles with higher ones, and for care and repair of existing lines		3,100.00
For contingent and incidental expenses of public buildings and grounds		500.00
For care of Washington Monument and maintenance of elevator:		
Salaries of employees	$9,060.00	
Fuel, lights, contingencies, etc	3,000.00	
		12,060.00
Total		210,609.70

(See Appendix D D D.)

NORTHERN AND NORTHWESTERN LAKES—SURVEYS—CORRECTING ENGRAVED PLATES—PRINTING AND ISSUING OF CHARTS.

Surveys on the Great Lakes by engineer officers were made more than two generations ago. There are upon the files of this office maps of localities made by such officers in the years 1817, 1819, 1824, 1826, 1827, and many of later dates up to the present time.

Up to 1841 these surveys were in connection with improvement of the various harbors, and of rivers tributary to the lakes. The needs of navigation demanding more than surveys of disconnected localities, the "Survey of the Northern and Northwestern Lakes" as a connected whole was commenced under an appropriation made March 3, 1841, of $15,000 for a "hydrographic survey of the coasts of the Northern and Northwestern Lakes of the United States."

This work was naturally assigned to the War Department, as its officers had theretofore been engaged in making local surveys and had

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charge of the works of improvement then in progress, and had been so engaged for a number of years; and Capt. W. G. Williams, then in charge of harbor improvements on Lake Erie, with station at Buffalo, was directed by a letter of May 17, 1841, to take charge of the survey and under the appropriation made March 3, previously. A few years thereafter the office was removed to Detroit, Mich., where it remained until the field work of the survey was completed in 1882, and that place has since remained the point for the distribution of the charts of the lakes.

From 1841 the survey of the lakes was carried on under the following appropriations:

Mar. 3, 1841	$15,000	July 2, 1864	$100,000
May 18, 1842	20,000	Feb. 28, 1865	125,000
Mar. 1, 1843	30,000	June 12, 1866	50,000
June 17, 1844	20,000	Mar. 2, 1867	155,000
Mar. 3, 1845	20,000	July 20, 1868	75,000
Aug. 8, 1846	25,000	Mar. 3, 1869	100,000
Aug. 12, 1848	25,000	July 15, 1870	100,000
Mar. 3, 1849	10,000	Mar. 3, 1871	175,000
Sept. 28, 1850	25,000	June 10, 1872	175,000
Mar. 3, 1851	25,000	Mar. 3, 1873	175,000
Aug. 30, 1852	25,000	June 23, 1874	175,000
Mar. 3, 1853	50,000	Mar. 3, 1875	150,000
Aug. 5, 1854	50,000	July 31, 1876	84,000
Mar. 3, 1855	50,000	Mar. 3, 1877	94,500
Aug. 30, 1856	50,000	June 20, 1878	49,500
Mar. 3, 1857	50,000	Mar. 3, 1879	85,000
June 12, 1858	75,000	June 16, 1880	40,000
Mar. 3, 1859	75,000	Mar. 3, 1881	18,000
June 21, 1860	75,000	Aug. 7, 1882	12,000
Mar. 2, 1861	75,000		
July 5, 1862	105,000	Total	2,939,879
Feb. 9, 1863	106,879		

The field work of the survey being completed, the office of the survey was closed in August, 1882, and the records transferred to this office. The printing of the final report was completed in November, 1882. Work in connection with the engraving and printing of the charts still remained, but of the appropriation of $12,000 last above mentioned, $2,382.32 was returned to the surplus fund of the Treasury.

At that time the charts were perfected to the full needs of navigation under the then existing conditions.

From the completion of the field work to the present time the following appropriations have been made, which have been applied to printing, electrotyping, and issuing charts for the use of navigators:

Mar. 3, 1883	$3,000	Mar. 3, 1891	$2,000
July 7, 1884	3,000	Aug. 5, 1892	2,000
Mar. 3, 1885	3,000	Mar. 3, 1893	2,000
Aug. 4, 1886	2,000	Aug. 18, 1894	2,000
Mar. 3, 1887	2,000	Mar. 2, 1895	2,000
Oct. 2, 1888	2,000		
Mar. 2, 1889	2,000	Total	29,000
Aug. 30, 1890	2,000		

To June 30, 1895, the aggregate of $9,657.20 has been turned into the Treasury from the sale of charts. Up to February 20, 1890, charts to vessels navigating the Great Lakes were, by regulation, issued free, not to exceed one set to each vessel; charts to other parties to be sold at 30 cents each. From and after that date no more free issue was made, and charts were sold at 30 cents each, this price continuing until July 16, 1890, since which date the price has been 20 cents.

Because of the phenomenal increase of commerce on the lakes, and under the stimulus of the increased depth made practicable through

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the St. Marys River by the completion of the new lock and the increase of depth obtained by the improvements made in the channels of the rivers and in the harbors of the lakes, the draft of lake vessels has steadily increased, and therefore the interests of navigation have required reexamination of certain shoaler areas sufficiently surveyed and charted for the older conditions of a 12-foot navigation.

In 1887 a vessel struck on a shoal and in 14 feet of water where 22 feet was shown. This obstruction was found to have been a detached bowlder about 6 by 4 feet on top, and this occurrence suggested the desirability of having funds available for limited surveys in such cases as this and for keeping the charts in all respects up to date. Accordingly an estimate of $10,000 was submitted with the Annual Report of 1887, which estimate was repeated for the Annual Report of 1888. An appropriation of $5,000 was made March 2, 1889, for "surveys, additions to, and correcting engraved plates." This and succeeding appropriations for the same purpose to date are as follows:

Mar. 2, 1889	$5,000	Aug. 18, 1894	$25,000
Aug. 30, 1890	10,000	Mar. 2, 1895	25,000
Mar. 3, 1891	10,000		
Aug. 5, 1892	5,000	Total	105,000
Mar. 3, 1893	25,000		

Under these appropriations reexaminations have been made of various localities, as shown by the annual reports, and quite extensive reexaminations are now under way on the St. Marys and St. Lawrence rivers.

Under the supervision of this office, and during the fiscal year, additions have been made to the engraved copperplates of charts of—

Lake Superior, No. 2.
Portage Lake and River.
River Ste. Marie, No. 1.
River Ste. Marie, No. 2.
Straits of Mackinac.
North end of Lake Michigan.
South end of Lake Michigan.
Coast chart, No. 1, Lake Michigan.
Coast chart, No. 7, Lake Michigan.
Coast chart, No. 9, Lake Michigan.
South end of Green Bay.
Lake St. Clair.
Detroit River.
Lake Erie.
Coast chart, No. 1, Lake Erie.
Coast chart, No. 6, Lake Erie.
Coast chart, No. 7, Lake Erie.
Sandusky Bay.
St. Lawrence River, No. 3.
St. Lawrence River, No. 4.

New electrotypes of the following plates have been made:

River Ste. Marie, No. 1.
River Ste. Marie, No. 2.

The following charts have been prepared and are now in the hands of the photolithographer:

Buffalo Harbor and head of Niagara River, scale 1:20,000.
Lake Superior, scale 1:500,000.

During the year 5,091 charts were distributed under the supervision of Col. O. M. Poe, Corps of Engineers, at Detroit, Mich. Of these 13 were sold at 25 cents each, 4,657 at 20 cents each, and 27 at 10 cents each. In addition, 56 charts were sold from this office at 20 cents each. The total amount received from the sale of charts was $948.55, which has been turned into the Treasury.

Chart No. 3 of the series of St. Marys River is in course of preparation, the data being entirely derived from the surveys made since 1893, in connection with resurvey of St. Marys River, and the improvement of the ship channel and Hay Lake Channel.

During the fiscal year surveys and examinations were in progress as follows:

Resurvey of St. Marys River from Whitefish Bay to Detour Lighthouse.—This survey is being executed under the supervision of Col.

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O. M. Poe, Corps of Engineers. The following work was done during the fiscal year: A few latitude and azimuth observations were made at the Soo Observatory for the purpose of obtaining data relative to the movement of the pole. Astronomical azimuth was determined at Station Gargantua and will be determined for several other stations.

The triangulation from Whitefish Bay to Detour was completed and computations made. The tertiary system made in connection with the improvements in St. Marys River was connected to the primary system at numerous points and some of the missing portions were supplied.

Magnetic observations were made in the vicinity of Sault Ste. Marie and at stations Gargantua and Crisp. This work will be continued at other primary stations.

About 100 square miles of topography were obtained for chart No. 2 of the new series for St. Marys River. The survey covered Sugar Island, the American shore to Sailors Encampment, and most of Lake George.

In connection with operations of improving the ship channel between Chicago, Duluth, and Buffalo and improving Hay Lake Channel, the hydrography of all channels in St. Marys River was obtained between Whitefish Bay and Sweets Point, about 4 miles above Detour, covering an area of about 176 square miles. The data for chart No. 3, St. Marys River, is complete; the field work for chart No. 2 is practically done, and the greater portion of that for chart No. 1 will be obtained this season.

For the completion of resurvey of St. Marys River and for obtaining the requisite additional data for the proposed chart of Whitefish Bay, $40,000 can be profitably expended during the fiscal year ending June 30, 1897, excluding amounts for other surveys on the lakes.

In addition, new charts of St. Marys River must be drawn, engraved, and printed. New shoals should be resurveyed as promptly as discovered. New light-houses, buoys, landmarks, channel improvements, etc., must be located and marked on existing charts. This work is accumulating and keeps increasing the longer it is postponed.

In view of all these facts the following estimate is submitted for the fiscal year ending June 30, 1897:

For printing and issuing charts for use of navigators and electrotyping plates for chart printing $3,000

For surveys and other expenses connected with correcting and extending charts, including resurvey of St. Marys River, to be available until expended. 50,000

(See Appendix E E E 1.)

Reexamination of St. Lawrence River.—This work is in charge of Capt. Smith S. Leach, Corps of Engineers. From the appropriation for survey of the Northern and Northwestern Lakes, in act of August 18, 1894, an allotment of $3,500 and a supplementary allotment of $250 were made for the continuation of the work noted under the above heading in the last annual report, making a total of $3,750 available during this fiscal year. It was expected that this sum would complete the project, and that expectation would have been realized but for time lost by accidents to the machinery of the tug employed for the work. It was intended to examine the main ship channel by continuous sweeping for a width of 2,000 feet, except when the natural limits are less, and from Lake Ontario to the foot of Brockville Narrows, a distance of 40 miles. Last year, with an allotment of $4,275, 9½ miles of the distance named were covered and 14 new shoals discovered. This year, with $3,750 expended, 25 miles have been accomplished. In this distance no dangerous shoals

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were found. The large discrepancy in the rate of progress is accounted for by the novelty of the undertaking and the inexperience of all concerned at the outset. The upper limit of the work was fixed at Blanket Island, a short distance above Clayton, as it seemed to the division and district engineers quite improbable that any shoals existed above that point. At the close of the fiscal year the field operations were completed and there remained to be done only the dismantling and storage of the equipment.

No changes were made in the general method of work and but minor ones in the details of operation.

(See Appendix E E E 2.)

Continual effort has been made to keep the charts up to date, and a very considerable number have been corrected during the year, and the special examinations made in connection with river and harbor work have been made use of whenever available. If it were not for this collateral assistance a number of very important charts would, owing to lack of funds to make surveys, be in a very imperfect and in some cases useless condition.

As soon as the funds available will permit, it is proposed to prepare and publish a general chart of Lake Michigan on one sheet, there being a great demand for the chart at present; also to prepare and publish charts of the harbors on lakes Huron and Superior in order to complete the set of charts of the lakes.

These projects, or something of a similar nature, will have to be carried out if the charts are to be rendered of the greatest service to navigators. The work already done, particularly the location of the dangerous shoals in Lake Erie, has fully demonstrated the necessity which exists for work of this character. The lake marine is of too great importance to the country at large for any effort looking toward its safety to be spared. When the Government sells charts to navigators these charts should embody the latest and most accurate information concerning the localities to which they refer, and everything should be done to render navigation safe and certain.

The low water of recent years, combined with the great increase in size and number of vessels, has resulted in the larger and more expensive vessels discovering dangers previously unknown, and discovering them by the costly process of striking them. All dangers so discovered should at once be surveyed and located upon the charts, in order to prevent the repetition of similar accidents at the same point. Localities deemed perfectly safe for navigation when smaller vessels were used are now regarded with suspicion by the larger vessels, and it is essential that certain special areas should be reexamined.

St. Marys River is one of the localities on the lakes where new surveys are essential in order that the charts may be rendered of the greatest service; the surveys upon which the present charts are based were made between 1853 and 1857, and since that time the region tributary to the river has undergone an enormous development. Nearly 11,000,000 tons of freight now pass through the river annually, and extensive works of improvement have been completed and are in progress. Since the original surveys were made the draft of vessels has increased from 9½ and 12 feet to 16 feet and will shortly be increased to 20 feet. The river is a difficult one to navigate with the large vessels of the present time, and new charts are absolutely essential. The records of the former survey and of the river improvement will prevent all duplication of work, and will permit the survey to be pushed to completion as quickly as possible.

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The organized districts in connection with river and harbor work now established at the chief cities on the lakes will greatly facilitate keeping all of the charts up to date, and will insure the maximum results with the minimum cost.

In view of the great importance of this work to the lake marine an appropriation of $50,000 for surveys and other expenses connected with correcting and extending the charts of the Northern and Northwestern Lakes is most earnestly recommended, as the conditions now existing are urgent and require that this amount should be available at the earliest possible moment, and an appropriation of $3,000 is recommended for the printing and distribution of the charts.

Annual water levels of the Northern and Northwestern Lakes.—A table showing the monthly means of water levels from July 1, 1894, to June 30, 1895, at Charlotte and Oswego, Lake Ontario; at Erie, Ashtabula, Cleveland, and Monroe, Lake Erie; at Milwaukee, Lake Michigan; at Escanaba, Green Bay (no observation being made at this latter place from January 1, 1894, to March 30, 1895); at Sand Beach, Lake Huron, and at Sault Ste. Marie and Marquette, Lake Superior, being in continuation of that published in the Annual Report of the Chief of Engineers for 1894, will be found in Appendix E E E 3.

MAPS.

Under the supervision of this office an outline map of the United States and Territories, showing the tonnage of the navigable rivers of the United States, 1894, was prepared and an edition printed.

RECONNAISSANCES AND EXPLORATIONS.

The following officers have been on duty at the headquarters of the military departments engaged in preparing such maps and making such surveys as were required by their respective commanding officers:

Maj. William L. Marshall, Corps of Engineers, at headquarters, Department of the Missouri.

Maj. Tully McCrea, Fifth U. S. Artillery, at headquarters, Department of the Columbia, until September 15, 1894, since which date Lieut. John L. Sehon, Twentieth U. S. Infantry.

Lieut. Charles G. Lyman, Second U. S. Cavalry, at headquarters, Department of California, until November 16, 1894; Lieut. Col. John I. Rodgers, Second U. S. Artillery, until June 4, 1895, since which date Lieut. J. F. Reynolds Landis, First U. S. Cavalry.

Maj. William L. Marshall, Corps of Engineers, engineer officer, Department of the Missouri, reports that no field work has been done during the year; that the office work has consisted in the preparation of maps and drawings, tracings, reproductions, etc., mounting and issuing maps; and that contour maps have been made of Forts Sill, Supply, and Wayne.

(See Appendix F F F 1.)

Lieut. John L. Sehon, Twentieth U. S. Infantry, acting engineer officer, Department of the Columbia, reports that field operations have been confined to surveys within the limits of the Vancouver and Boise military reservations, in addition to determining the height of Vancouver above sea level. Office work has been continued correcting the department map, making tracings, and mounting and issuing maps for official use.

(See Appendix F F F 2.)

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Lieut. J. F. Reynolds Landis, First U. S. Cavalry, acting engineer officer, Department of California, reports that the office work has involved the preparation of original drawings, tracing, and blue printing maps, etc.; the mounting and distribution of maps, and the care, repair, preservation, and issuing of instruments. No field work has been entered into during the year.

(See Appendix F F F 3.)

ESTIMATES FOR AMOUNTS REQUIRED FOR SURVEYS AND RECONNAISSANCES IN MILITARY DEPARTMENTS, AND FOR MAPS, INCLUSIVE OF WAR MAPS.

For military surveys and reconnaissances and surveys of military reservations by the engineer officers attached to the several headquarters of military departments, being an average of $2,142.86 for each of seven military departments west of the Mississippi River, $15,000; for publication of maps for use of the War Department, inclusive of war maps, $10,000; total $25,000.

Attention is specially invited to this estimate for appropriation and to the important uses for which it is intended.

At the headquarters of the military departments west of the Mississippi River there are stationed officers of the Corps of Engineers, or other officers detailed to act, whose duty it is to make reconnaissances for military purposes, to make such surveys and prepare such maps as may be required by their respective commanding officers. In recent years no appropriations have been made for these purposes, and, consequently, these officers have been very much cramped for lack of the necessary means, and the usefulness of their offices has been very much reduced in consequence. The maps of these departments are constantly in need of revision and additions, which the officers make so far as possible, but with no means, even for the purchase of paper, their efforts are limited in results.

Paragraph 383 of the Army Regulations requires that the commanding officer of each post where there are fixed batteries bearing upon a channel will call upon the Engineer Department for accurate charts showing the soundings to the extent of the ranges of the guns. Calls upon this department to perform its duty under this regulation can not be honored from lack of means.

Interest in the war maps published by this office and republished by virtue of the sundry civil act of March 2, 1889, continues very active. Of the 1,100 copies of each map printed under the act alluded to, all those not printed in this office (47 sheets) have been exhausted for sometime, and the calls for them can only be honored with sets deficient in that number of sheets.

Besides all this, there is much information in this office relative to military geography which could with little expense be made available for the information of officers of the Army; for instance, there are on the office files detailed maps of regions of Europe which may become at an early day the theaters of war, and it would be of great advantage to the service if such information as these maps give could be made available for the study of officers, especially on the outbreak of hostilities. Were the means provided, this office would be glad to compile and to disseminate the information on its files.

It is the policy of this country to keep a standing army small in numbers, but it is its expectation that it should be a highly instructed one, and a small outlay as here referred to will be conducive to that end.

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Applications from officers of the Army have been received for maps of certain regions of Europe, and it was with great regret that this office could not render this assistance to officers desirous of improving themselves professionally, especially when the material was on its files.

OFFICE OF THE CHIEF OF ENGINEERS.

During the fiscal year ending June 30, 1895, the following-named officers were on duty in this office as assistants:

Lieut. Col. A. Mackenzie, since June 8, 1895;
Maj. Henry M. Adams;
Maj. Thomas Turtle, until September 18, 1894;
Maj. John G. D. Knight, until March 30, 1895; and
Capt. George W. Goethals, since October 8, 1894.

Very respectfully, your obedient servant,

W. P. CRAIGHILL,
Brig. Gen., Chief of Engineers.

Hon. DANIEL S. LAMONT,
Secretary of War.

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APPENDIXES

TO THE

REPORT OF THE CHIEF OF ENGINEERS,

UNITED STATES ARMY.

501

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APPENDIXES

TO THE

REPORT OF THE CHIEF OF ENGINEERS,

UNITED STATES ARMY.

FORTIFICATIONS, ETC.

APPENDIX No. 1.

PORTLAND HARBOR.

Officer in charge, Lieut. Col. Peter C. Hains, Corps of Engineers, until November 5, 1894, and Lieut. Col. D. P. Heap, Corps of Engineers, since that date.

Three emplacements for 10-inch rifles.—This work was begun in April, 1893. In November, 1894, two emplacements were completed except the details necessary to accommodate the carriages.

The entire cost of the two emplacements has been $90,261.05. The quantity of concrete was about 12,450 cubic yards, and the cost per cubic yard, inclusive of cost and maintenance of plant, temporary buildings, etc., and all contingencies, was about $6.20.

The ledge excavation at the site of the battery cost about $1.43 per cubic yard, and the earth cover averaged about 68.5 cents per cubic yard.

NARRAGANSETT BAY.

Officers in charge, Capt. W. H. Bixby, Corps of Engineers, with First Lieut. W. W. Harts, Corps of Engineers, under his immediate orders until June 8, 1895, and in temporary charge since that date.

The endeavors of the United States were continued to secure legal possession of a small disputed area of land near the southeast corner of the Government reservation at Fort Adams. A suit of ejectment was commenced in August by the U. S. district attorney against the present occupant of the three-fourths of an acre under controversy; the question of the fort boundary line was argued before the district court on February 11, 1895, and judgment was rendered in April, 1895, for the defendants. Notice, however, was received under date of May 15 from the U. S. district attorney that he had been further directed by the Attorney-General to "institute appropriate judicial proceedings on behalf of the United States for the settlement of the disputed boundary" at Fort Adams; these proceedings being of the nature of a suit in equity to determine and fix the United States boundaries at this disputed locality.

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NEW YORK HARBOR.

Batteries in the charge of Col. H. M. Robert, Corps of Engineers, with First Lieut. W. E. Craighill, Corps of Engineers, assistant.

Five-gun battery for 8-inch rifles.—All material, including that for concrete, except sand, has been purchased and generally hauled by contract. Sand has been excavated upon the reservation and hauled by contract to bins provided for the purpose. A contract was also made for the embankment of the parapet. The manufacture of concrete has been carried on by hired labor, using machinery to handle the material from the bins, to mix the concrete and to deliver it on the work. The mixer used has been a cubical one, 4 by 4 by 4 feet, driven by a 10-inch belt running on the drum of a small hoisting engine. This arrangement gives the engine driver complete control of the mixer, and has proved very satisfactory.

Important contracts entered into during the year have been as follows:

Hauling broken stone, 4,000 cubic yards, at 44½ cents.
Hauling rubblestone, 1,500 cubic yards, at 47 cents.
Excavating and hauling sand, 3,000 cubic yards, at 47 cents.
Rosendale cement, "Old Newark," 8,000 barrels, delivered on the dock, at 77.4 cents.
Broken stone (bluestone), 4,000 cubic yards, delivered on the dock, at $1.09½.
Broken stone (bluestone), 2,500 cubic yards, delivered on the dock, at $1.09.
Rubblestone, 1,500 cubic yards, delivered on the dock, at 75 cents.
Rubblestone, 1,800 cubic yards, at 75 cents.
Gun-metal castings, 1,151½ pounds, at 19.98 cents.
Spruce and pine lumber for store and sand bins, 21,407 feet, B. M., for $399.67.
Spruce lumber false works, at $18 per M., B. M.
Excavation and embankment, 2,500 cubic yards, at 32½ cents.
Hauling and storing cement at 2½ cents per barrel.
For structural steel and iron work, 20,000 pounds:
  Steel frames, channels, and angles, at 1¼ cents per pound.
  Bolts, washers, and nuts, at 5 cents per pound.
For loading and hauling empty cement barrels, 8,000 barrels, at ⅛ cent per barrel.

The quantity of masonry constructed has been 6,300 cubic yards, composed of 5,500 cubic yards of concrete (1 cement, 3 sand, and 5 broken stone) and 800 cubic yards large stones embedded in the concrete.

Nine hundred and sixty-eight cubic yards of earth has been placed in the parapet under contract at 32½ cents per cubic yard.

The estimated quantities remaining to complete the battery are 3,150 cubic yards of masonry and 6,500 cubic yards of earthwork.

Purchase of land adjacent to Fort Wadsworth, N. Y.—The Secretary of War directed that the property of Mrs. Sarah Schuyler Martin (about 6½ acres), which is needed for fortification purposes, be purchased by the United States for the sum of $44,000 and interest at 6 per cent on said sum from June 26, 1891, to date of payment, and an allotment of $54,000 was made by the Chief of Engineers December 26, 1894, for completing the purchase. With the assistance of the United States attorney for the eastern district of New York, and after the title to said property had been declared valid by the Attorney-General of the United States, and all mortgages, tax liens, and other incumbrances satisfied, the purchase was completed on February 25, 1895, and payment made as follows:

Purchase price	$44,000
Interest from June 26, 1891, to February 25, 1895, inclusive (at 6 per cent per annum)	9,680
	53,680

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Batteries in the charge of Lieut. Col. G. L. Gillespie, Corps of Engineers, with First Lieut. Robert McGregor, Corps of Engineers, assistant.

Battery of seven 10-inch guns on disappearing carriages.—The pavement of the superior slope was completed, using Rosendale cement mortar for all except a semicircle of 25 feet radius under the gun, which was covered with granolithic pavement composed of 1 part Portland cement to 1½ parts crushed granite.

The following table gives the cost of the various operations of construction during the year:

Material and labor for pavement of superior slope, 465 square yards, at $2.13	$990.66
Material and labor for pavement of interior rooms and passages, 260 square yards, at $1.86	482.72
Cost of altering two traverse magazines into casemates for rapid-fire guns	737.39
Drainage system for two magazines	395.72
Twelve doors for magazines and entrances	398.08
Grading and sodding 6,442 square yards slopes, at $0.197	1,256.72
Incidentals, including superintendence and office expenses	875.78
Watchman's time since September 30, 1894	400.00
Inventory of supplies on hand	843.46
Total expenses for year	6,380.53

Mortar battery with ditch defense.—The final battery firing was made on April 11, 1895, at which time two volleys were fired from the battery at horizontal targets on land with the intention of subsequently locating the shells, which had been marked for identification.

The first volley was at a target 6,000 yards distant, with a charge of 60 pounds brown prismatic powder and an elevation of 60 degrees.

The second volley was at a target 3,000 yards distant, with 29 pounds hexagonal powder and the same elevation as above, 60 degrees.

The projectiles used in each case were the service 800-pound projectiles.

In each volley the mortars were fired electrically in groups of four, at two-second intervals, the operator being located in the firing recess at the north end of the longitudinal gallery, electrical connection being made through a switch board. A single igniter, the Laflin and Rand No. 4, was used for firing the entire battery.

A report by Col. H. L. Abbot, Corps of Engineers, Brevet Brigadier-General, U. S. A., upon the probable accuracy of fire of the mortars of a battery when served in volleys from separate pits, based upon certain firing made at this battery, is appended. (See Appendix No. 2.)

On March 15, 1895, a project was submitted for lighting the interior of the battery by electricity, and also for an overhead hoist and traveler along the longitudinal gallery to facilitate the service of ammunition.

The project was approved, and the sum of $952 allotted for this purpose.

The installation of the lights, which was completed in time for the firing on April 11, consists of twelve incandescent lights of 16 candlepower, located along the longitudinal gallery, and six lights of 24 candlepower in the interior rooms, operated by an accumulator charged from the dynamo located at the gun-lift battery, 2,000 feet distant.

The accumulator consists of 42 cells of the chloride type, with a capacity of 100 ampere hours at the normal discharge rate of 10 amperes, with an electromotive force of 80 volts.

The lamp used is an 80-volt lamp with a high efficiency (2½ watts per candlepower).

The cost of the above installation was $474.53.

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The accumulator is charged for the occasional uses in time of peace at the gun-lift battery, and afterwards transported to the mortar battery when required.

When it is desired to install the accumulator permanently it is the intention to connect the battery in two branches of 21 cells each, giving a voltage of 40, with a normal discharge rate of 20 amperes. This will allow for the necessary fall of potential in the charging leads. The present lamps would be replaced by 40-volt lamps of the same efficiency.

Final report, with full description of the battery, was submitted to the Chief of Engineers May 7, 1895, in which the following statement of expenditures for the battery as actually constructed appears:

Expenditures.

Purchase and erection of plant for construction	$15,923.39
Construction of battery proper	228,498.54
Platforms for 16 carriages	25,330.74
Total cost, without armament	269,752.67
Assembling 12 carriages, and mounting mortars thereon	3,600.00
Balance on hand, May 1, 1895	699.33
	274,052.00

Cost of armament.

Sixteen spring-return carriages	$144,000.00
Sixteen C. I. steel-hooped mortars	120,000.00
Total	264,000.00

Gun-lift battery for two 12-inch rifles.—Excavations for the foundations of the northern half of the battery were commenced in January, 1891, under instructions from the Chief of Engineers dated February 20, 1890, and September 13, 1890; and on April 3, 1891, further instructions were received for the construction of the southern half of the battery.

The final drawings of the completed battery, with description and specifications, were completed and forwarded on January 4, 1895.

The following is a tabular statement of the expenditures actually incurred on the construction of the battery, to which is appended statement of estimated cost of armament:

Cost of construction of Gun-Lift Battery No. 1.

[March 1, 1895.]

Installation of construction plant		$25,473.23
Battery construction:		
42,410 cubic yards concrete and masonry, including material for forms, superintendence, and all incidentals appertaining to concrete and stone construction, at $5.70	$241,628.84	
Sand filling in core and glacis	4,326.74	
Drainage system	322.92	
Doors and interior fittings	3,650.77	
Ammunition service	1,770.52	
Water supply plant	833.66	
Electric plant	4,661.55	
		257,195.00
Mechanism and power for two lifts		172,360.00
Cost of battery without armament		455,028.23
Armament (estimated):		
2 carriages, 12-inch, Le Creusôt pattern	$38,000.00	
2 B. L. rifles, 12-inch, model 1888 M	100,000.00	
Cost of assembling and mounting	3,458.93	
		141,458.93
Total cost of battery complete		596,487.16

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Pending the completion of the manufacture and mounting of the armament of this battery, when a test of speed could be made, experiments were begun and completed in November, 1894, to determine the rate at which the existing power would admit of operating the lifts; and for this purpose the second gun was placed on its lift on blocking, together with a suitable dead weight to represent its carriage.

The results of the experiments were forwarded to the Department in letter from this office dated January 16, 1895, of which the following is an extract:

The programme laid down was in substance as follows: Starting with the full accumulator head and both lifts down, one lift was sent up and the time noted; the lift was immediately lowered as soon as the locking bolts had locked, and a record kept of the time of ascent and descent. The ammunition hoist and rammer were then operated, and the time of ascent and descent of the ammunition hoist recorded, after which the time was noted when the accumulator head was restored ready for a second lift.

The same operations were then performed with the other lift, keeping a record of the time consumed in each stage, after which the same programme was repeated, operating the two lifts alternately.

A record was kept of the steam pressure at the beginning and end of each operation, as well as of the amount of water in the boilers during the experiments.

The amount of the friction on the lift rams varies with the condition of the surfaces of the ram and stuffing box as regards lubrication. Records of this friction have been made varying from 15 to 30 pounds per square inch of cross section, or from 95 to 189 pounds per inch of circumference of ram.

On the accumulators, the difference of friction is occasionally sufficient to cause both accumulators, differing in weight by 7 tons, approximately, to descend together, indicating a difference of 230 pounds per inch of circumference of accumulator ram.

The rates of ascent and descent of the gun and ammunition lifts depend on the promptness of the operators in opening the valves, since the lifts are operated by a constant water pressure, and are in no wise affected by the capacity of the plant. This fact made it possible to omit a repetition of these observations each time, and to thus greatly facilitate the tests.

The following times, repeatedly verified, are here given:

Gun lift:

Time of ascent, 15 to 17 seconds.

Time of descent, 17 to 20 seconds.

Ammunition lift:

Time of ascent, 7 seconds.

Time of descent, 10 seconds.

It is possible to send the gun lift either up or down in 15 seconds, including time for operation of the locking bolts.

The tests were made November 7, 13, 17, and 21. No especial preparations were made, and the conditions were the same as those under which the mechanism is constantly operated for use of the Ordnance Department.

If it should be desired to increase the steam capacity of the boilers this can be done with but slight expense in the following ways:

1. Covering with asbestos all steam pipes and exposed boiler surfaces, to retain the heat.

2. Lengthening the grate surface. This can be done by moving the bridge wall of each furnace back about 1 foot, increasing the grate surface by one-sixth. The grates are now 6 feet long, and with the additional length they could still be fired by one man, as at present.

3. Supplying a feed-water heater, by which the feed water—500 gallons per hour—which is now supplied cold, could be heated by the exhaust steam before entering.

The second carriage for this battery was delivered May 17, and the gun mounted thereon June 5. The Chief of Engineers was notified by letter June 7, 1895, of the completion of the battery.

PHILADELPHIA.

Officer in charge, Maj. C. W. Raymond, Corps of Engineers, with Second Lieut. Spencer Cosby, Corps of Engineers, as assistant.

Three-gun lift battery.—A careful study of the plans received with Department letter dated August 11, 1894, was made with a view to

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economy and local details before submitting working drawings, and during the month of November, 1894, an examination and accurate measurements of the existing work within the limits of the proposed battery were made, the work plotted, and the location of the proposed battery fixed. Landing piers, sluice gates, and buildings were also examined, to ascertain what repairs were necessary to make them serviceable. An examination of the Delaware River had been made previously to determine the positions of the curves of depth on either side of the channel for defensive purposes. The working drawings are now nearly completed, and a project for the execution of the work will be submitted at an early day.

Under a contract dated April 19, 1895, lumber for the concrete plant was delivered, at a cost of $1,878.40. The construction of this plant was in progress.

Contracts for material for an electrical plant were entered into, dated April 5, 1895, for engines, boilers, generators, switch board, and testing apparatus, for the sum of $2,975; dated April 13, 1895, for an electric locomotive, for the sum of $1,200; dated April 8, 1895, for line accessories, for the sum of $432.34. An agreement dated April 18, 1895, was entered into for 2 electric derrick motors, for the sum of $1,800. The boiler, engines, and generators were set up and a house built for their protection. The trolley line was constructed, and the plant was practically complete and ready for operation.

Bids for furnishing and delivering 2 pile-driving derricks at a cost of $812; for furnishing and delivering 2 concrete mixers at a cost of $482 each; for furnishing and delivering steel rails, switches, etc., at a cost of $1,101.58; for furnishing and delivering 100 piles at a cost of $750; for furnishing and delivering 4 Lidgerwood engines at a total cost of $2,060; and for furnishing and delivering 1 Lidgerwood upright tubular boiler and fittings at a cost of $571.50, were accepted. These articles were not delivered at the close of the fiscal year 1895.

On March 12, 1895, an agreement was made for furnishing and delivering a naphtha launch at a total cost of $1,950. The launch was delivered on June 7, 1895, and has been engaged in transporting materials and employees.

HAMPTON ROADS.

Officer in charge, Maj. C. E. L. B. Davis, Corps of Engineers, with First Lieut. D. DuB. Gaillard, Corps of Engineers, as assistant since February 12, 1895.

Breakwater.—A severe easterly gale lasting nearly four days, from September 26 to 29, inclusive, in 1894, seriously damaged the pile breakwater between the Hygeia Hotel and the Engineer wharf, eroded the beach in rear of Jetty No. 1, and washed out the railroad track near the water battery. The breakwater was washed out for some 60 feet or more of its length and the bank in rear cut out from 10 to 40 feet, so that in case of other severe gales from the same quarter there was great danger of the sea cutting through into the moat of front No. 1. It is said that some years ago a cut was made through the same place into the moat and was afterwards filled up with broken concrete and stone, and the caving away of the bank during the September gale exposed this old filling, as well as an old sheet-pile breakwater some 12 feet in rear of the present line.

A report of the damage, with an estimated cost of $9,100 for rebuilding the breakwater, was submitted October 4, 1894, but no funds were available at that time. March 12, 1895, an allotment of $9,100 was

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made from the appropriation for preservation and repair of fortifications, act of March 2, 1895, for rebuilding the breakwater.

The breakwater was built many years ago of closely driven round piles with a backing of boards to keep the sand from running through. The structure from natural causes had deteriorated, and though repaired from time to time, was finally broken through in the manner stated.

Lieut. D. DuB. Gaillard, Corps of Engineers, submitted a project for a breakwater of concrete similar in design to a sea wall built by him under the direction of Capt. W. M. Black, Corps of Engineers, for the protection of the shore at the north end of Fort Marion, St. Augustine, Fla., which he stated had withstood uninjured the effects of two severe cyclones. The advantages of concrete over pile work are so obvious that a further study was given to the subject to see if the concrete structure could be built within the limits of the allotment, and it having been decided that it could, a plan was submitted to and approved by the division engineer, Col. W. P. Craighill, and authorized by the Chief of Engineers April 17, 1895, the breakwater to be built by hired labor, and the purchase of material in accordance with regulations pertaining thereto.

The plan proposed consists of a continuous wall of concrete, the cross section showing a footing course 2 feet high and 5 feet thick sunk some 8 feet below the beach level, with a superstructure 4 feet wide, at bottom, 2 feet at top, and 8 feet high, the rear face vertical and the front with a batter of one-fourth.

Proposals were solicited on ten days' notice for furnishing broken stone and Portland cement, and the following were received and opened April 27, 1895:

For furnishing 350 cubic yards of small broken stone.

Name and address of bidder.	Price per cubic yard.	Estimated amount.
Chas. G. Smith & Son, Washington, D. C	$2.42	$847.00

For furnishing 950 barrels, more or less, of Dyckerhoff Portland cement.

Name and address of bidder.	Price per barrel.	Estimated amount.
H. L. Cranford, Washington, D. C	$2.84	$2,698.00
E. Thiele, New York City	2.85	2,707.50

The sea wall is built 4 feet 9 inches in front of the old pile breakwater, and is constructed as follows:

A base box 2 by 5 by 9 feet, made of 2-inch boards, and without top or bottom, is sunk to the proper depth by excavating from the inside and pounding its edges with rammers at the same time.

To enable this box to be sunk with ease in water from 0 feet to 2 feet in depth a simple but efficient cofferdam has been devised. This cofferdam is built in sections (each side and each end constituting a section) and consists of two parallel walls of 1-inch by 12-inch boards, 3 feet in height and 18 inches apart, connected by simple interior bracing. This cofferdam is set up parallel to the base box just described, and about 4 feet from it. The sand excavated from the interior of the base box is thrown into the space between the parallel walls of the cofferdam. When enough sand has been thrown in to fill the coffer-

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dam up to a height of about 2 feet the water within is pumped out with a hand pump and the base box is then readily sunk to place and is protected by the cofferdam from waves and the swells caused by passing steamers.

When the base box has been sunk to place and pumped out it is quickly filled with thoroughly mixed dry concrete, well rammed. When filled, strips of board 1 inch by 6 inches by 9 feet are nailed over the top of the box at its inner and outer edges, and against the inner edges of these boards rest the sides of the movable boxing. This boxing, for convenience in handling, is made in 7 pieces, and corresponds, like the base box, to a section of the sea wall 9 feet in length. Of the 7 pieces of the movable boxing 3 are face pieces, 3 are back pieces, and 1 is an end piece of the same dimensions as the cross section of that part of the wall above the base.

The end piece is set up on the outer end of the base box 9 feet from the completed vertical end of the concrete wall. Against this end piece and the finished end of the wall are assembled the face and back pieces, which are fastened by suitable clamps and exterior bracing, and then concrete is put in in the ordinary manner. Whenever seepage water ceases to gain on the rammers, concrete with the usual amount of water is added instead of dry concrete. When the concrete has set about fifteen hours the movable boxing can be taken down and used on the next section of wall. The base box remains in place.

An attempt is made to bond each section of the wall with the preceding section by covering the vertical face of the latter with a mortar of one part cement and one part sand, but it yet remains to be seen whether or not this will prove efficacious.

Whenever suitable stones can be found in the vicinity of the work they are built into the concrete, being first well wetted and then sprinkled with cement.

The construction was commenced at the Engineer wharf, and at the close of the fiscal year 272 feet 8 inches of wall had been completed, and the washed-out area filled in for a distance of 155 feet from the Engineer wharf. In the construction of this wall there have been used 297 barrels Portland cement, 19.5 cubic yards gravel, 91.7 cubic yards fine broken stone, 184.1 cubic yards coarse broken stone, and 40.3 cubic yards riprap (solid measure), built into the wall, giving 354.7 cubic yards of concrete.

Beach protection.—The beach forming the shore of Chesapeake Bay to the northeastward of Fort Monroe, had for some years been subject to erosion by tidal currents, and particularly by the action of waves during northeast storms. The erosive action had progressed to such an extent that it was thought there was danger that this narrow strip of land connecting Fort Monroe with the mainland would be cut through. This strip of land, communicating with the cemetery and the only area of ground not occupied by buildings, is now the site of proposed gun and mortar batteries and its permanent preservation becomes important.

A project at an estimated cost of $37,000 was submitted for the construction of jetties at suitable intervals along the beach to protect it from further erosion. An allotment of $10,000 was made from the appropriation for preservation and repair of fortifications, and on February 24, 1891, $27,000 was appropriated for this purpose. The jetties were at first constructed of a core of oyster shells covered with heavy riprap stone. In order to diminish the cost the cheaper plan was afterwards adopted of a pile jetty consisting of a continuous row of piles

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and sheet piling, oyster shells and riprap in much smaller quantities being placed on each side of the piles.

Under this project four jetties were built, numbered 1 to 4 inclusive. Jetty No. 1 is about 900 feet above the light-house wharf and the other jetties are from 900 to 1,000 feet apart to the eastward. A pile breakwater 570 feet long was built between the light-house wharf and Jetty No. 1, and a sea wall 170 feet long near the light-house wharf. Jetty No. 1 is built of oyster shells and riprap stone and is 165 feet long. Jetty No. 2, built in the same manner as No. 1, is 300 feet long. Jetty No. 3 is built of oyster shells and riprap for a length of 127 feet, and for a length of 273 feet is built with a pile center as above described, with shells and riprap piled on each side. This jetty has two wings 21 and 73 feet long respectively. Jetty No. 4 is built with the pile center. The main jetty is 271 feet long with a shore connection 64 feet long of shells and stone, and two wings of 45 and 168 feet in length. In January, 1892, the funds having been nearly exhausted, work was suspended, and no work has been done under this project during the fiscal year ending June 30, 1895.

In a report dated June 20, 1894, it was stated:

> The protection of a sandy shore by spur dikes, or groins normal to the shore line is an experiment the success or failure of which can only be determined by actual trial, and it may be that other and much more expensive means will have to be finally resorted to in order to protect the important interests of the Government at this point, but I do not think the present project should be abandoned or changed until it has had a fair trial, and certainly two years is too short a time to determine whether the project is a success or not.

A personal inspection of the entire beach of the reservation covered by the groins was made on March 11, 1895. There is no question that the beach is making out above groins Nos. 4 and 3, and it is only a question of a few years when the beach will be out to the ends of all four of the groins built in 1891–92 to protect the beach from erosion, and then the sand washed along around the ends of the spurs will be deposited in front of the site of the breakwater and the beach will be re-formed and restored to its former condition in that locality.

Sewerage system.—The present system of sewerage at Fort Monroe is seriously defective. It drains only the buildings within the walls of the fort, while the only provision for drainage of quarters outside of the enceinte is by cesspools or pipes leading to the water where the latter is within reasonable distance.

The main sewer of the fort is flushed by tidal water impounded in the moat and discharges its sewage into Mill Creek, where it is often washed up along the shore and becomes offensive.

The Hygeia Hotel has a pipe leading from the hotel premises along the beach into Chesapeake Bay and pumps its sewage through it, but an ordinarily severe storm is almost sure to break the pipe on the beach, and repairs are frequent. The Sherwood House has a cesspool to receive its sewage which is cleaned at frequent intervals, but the arrangement is defective and objectionable. The new hotel, not yet completed, had very extensive plumbing fixtures throughout, but no arrangement has been made for sewage disposal.

March 2, 1889, Congress made an appropriation of $25,000 "for the construction, *complete*, of a sewerage system." Specifications were prepared, but the lowest bid far exceeding the appropriation, all bids were rejected, and no work was done.

In the report for 1893 an outline of the previous attempts to solve this very pressing and troublesome problem was given; the various

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reports of the local officer; the question of whether there should be one system for the military residents and another for the hotels and civilian residents, or a joint system; the action of the Secretary of War during the season of 1892, while the excitement due to the existence of cholera in the country was at its height, and the Surgeon-General of the Army was urging immediate action, being given in some detail.

On October 26, 1892, a plan was submitted by this office for a joint system of sewerage for the entire reservation, including both military and civilian residents, at a total estimated cost of $75,000, with suggested regulations for the use of the system, estimated cost of maintenance, and suggested provisions for its preservation, repair, and maintenance, and a project for apportioning the cost based upon the number of occupants of the various buildings.

Congress, by act approved August 1, 1894, appropriated the sum of $37,500 for one-half of the cost of construction of a sewerage system for all buildings at Fort Monroe, Va., with the proviso that the owners of hotels and other nonmilitary buildings should bear one-half of the expense of constructing said sewer, and the Secretary of War was authorized to apportion among, assess, and collect from said owners the moiety of the estimated cost.

The Secretary of War having referred the subject to this office with certain indorsements, to which attention was particularly invited, viz, that the amount of expenditure contemplated by Congress was greatly in excess of the necessary cost of a thoroughly efficient sewer system in the opinion of some of those who would have to contribute, a report was submitted with the suggestion that a civilian expert might be employed. A project was therefore devised by Mr. Rudolph Hering at an estimated cost of $41,320, with a proviso that it might be well to have an extra bid for concrete, timber, and brickwork in case additional quantities should be required. To provide for these contingencies, as well as for cost of inspection, superintendence, fee of expert, etc., the estimated cost was increased to $45,000, and on that estimate the moiety was assessed on the nonmilitary residents by order of the Secretary of War, in accordance with the table contained in the regulations for the construction of sewer at Fort Monroe, published in War Department Circular of November 5, 1894.

On November 12 and 13, 1894, all of the owners and occupants of nonmilitary buildings at Fort Monroe were notified, by personal service, in compliance with the provisions of the act, of the amount severally assessed against them for the construction of the sewerage system, and they were directed to deposit the sums designated in the National Metropolitan Bank of Washington, D. C., the depository designated by the Secretary of War, on or before December 14, 1894.

The proprietor of the Sherwood Hotel was a day late, but with the exception of the Hampton Roads Hotel Company all of the others were on time. In accordance with the rules and regulations published November 5, 1894, by order of the Secretary of War, failure to deposit the whole or any part of the sum assessed should have caused the place of business of the said property owner to be closed forthwith, but at a personal interview on December 17, 1894, the Secretary of War directed that the matter rest for a few days. Subsequent interviews were had with the Secretary of War, but it was not until January 18, 1895, that the money was deposited by the representatives of the hotel company, which delayed the work very seriously.

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The following table shows the amounts assessed, dates of deposit in National Metropolitan Bank of Washington, etc.:

Name.	Per cent of moiety.	Date of deposit.	Amount.
1. Hygeia Hotel	44.7	Dec. 14, 1894	$19,057.50
2. Chamberlin Hotel	45.5	Jan. 18, 1895	10,237.50
3. Sherwood Hotel	5.5	Dec. 15, 1894	1,237.50
4. Chesapeake and Ohio Railway	1.1	Dec. 13, 1894	247.50
5. Adams Express Company	.4	Nov. 24, 1894	90.00
6. Wm. H. Kimberly	.7	Dec. 13, 1894	157.50
7. Wm. Baulch	.6	Dec. 8, 1894	135.00
8. J. A. Watkins	.9	Dec. 11, 1894	202.50
9. United States Light-house	.3	(*)	.....
10. Capt. R. D. Evans	.2	Nov. 21, 1894	45.00
11. Rev. Mercer	.1	Dec. 3, 1894	22.50
Total	.....	.....	22,432.50

*The Light-House Establishment to pay its share of the moiety, $67.50, on the completion of the work.

The specifications were prepared and printed, proposals invited by public advertisement of November 28, 1894, and bids opened December 29, 1894. Ten bids were received, ranging from $34,482.50 to $65,051.40, as follows:

No.	Name and address of bidder.	Price for entire work.
1	Thos. L. Rosser, jr., Minneapolis, Minn	$34,482.50
2	Hankins, Mosby & Kelly, Richmond, Va	41,204.90
3	John Jacobi, Wilmington, Del	42,597.00
4	Crook, Horner & Co., Baltimore, Md	45,798.52
5	Joseph Jenkins, Wilmington, Del	47,244.50
6	Isaac G. Brown, New York City	51,598.50
7	Corcoran & Connell, Pittsburg, Pa	53,135.70
8	Owen Pattison, Baltimore, Md	55,577.50
9	T. Bresnan & Co., Baltimore, Md	62,715.25
10	H. Davin, Roanoke, Va	65,051.40

NOTE.—The different parts of the system were bid for separately: all the sewer pipe by the linear foot; the flush tanks and manholes, a price each; the sewage reservoir and the pumping station, constructed complete; and extra brick masonry and concrete by the cubic yard.

As the Hampton Roads Hotel Company had failed to deposit its assessment no steps could be taken with reference to awarding the contract. As soon as the money was deposited, an abstract of proposals was submitted to the Chief of Engineers on January 19, 1895, and the contract was awarded to the lowest bidder, Thomas L. Rosser, jr., of Minneapolis, Minn., January 25, 1895, and entered into January 29, 1895, the work of construction to be commenced within forty-five days after notification of acceptance of the bid, or March 12, 1895, and to be completed on or before the end of the calendar year, 1895. As there were no detailed drawings furnished by Mr. Hering, they had to be prepared in this office and consumed considerable time in their preparation.

In the printed specifications the character of the bottom was given as generally sand. This was the common impression of those familiar with the locality. The record of the borings of the artesian well sunk at Fort Monroe in 1864, as compiled from Professor Fontaine's notes, was as follows: From 1 to 30 feet, white beach sand; 30 to 40 feet, yellow beach sand; 40 to 43 feet, small bowlders. So the indications were that for a depth much below any structure necessary for a sewerage system the character of the soil would present no peculiar difficulties. Mr. Hering's project called for a cylindrical sewage reservoir of brick, 50 feet interior diameter, built upon an iron curb or shoe with cutting edge, and sunk as excavation proceeded. The bottom of the tank of

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concrete, to be conical in shape, 17 feet at the center and 14 feet at the circumference below mean low tide.

As soon as the money assessed on the nonmilitary residents was deposited and became available, borings were made on the proposed site of the reservoir. These borings showed a stratum of soft material at a depth of 14 feet below mean low tide, consisting of black quicksand mixed with mud and water, that rose 6 feet 9 inches in the boring tube. This material is too soft to support any heavy structure upon it, and it became necessary to continue the wall of the reservoir to hard bottom at a depth of 26 feet. In the specifications for the reservoir a clause was inserted: "Any additional concrete or brick masonry which the engineer may deem necessary to ensure the successful completion of the reservoir will be paid for at the contract prices fixed for concrete and brick masonry." Under this provision it was concluded to sink the curb through the soft stratum into the harder material beneath, the United States to pay for the extra brick curbing required. But the contractor, after much careful study of the borings and consultation with the engineer who built a large gas holder at Duluth, Minn., in quicksand, concluded that this method involved great risk, as in case of striking an obstruction, like a sunken log, or the shoe not finding a horizontal bottom, the reservoir might cant over and perhaps break up. He therefore submitted a plan which is practically the method employed in constructing the Duluth gasometer—viz, a circular trench of sufficient width to allow of the construction of the wall, the sides being lined with sheet piling well shored and braced, the bottom to have a footing of concrete in place of the iron shoe, the trench to be then pumped dry and the wall laid. The exterior of the trench is to be filled in with sand. The interior of the reservoir is then to be excavated down to the hard stratum and refilled with sand up to the grade of the concrete bottom of the reservoir, which will then be constructed on the compacted sand.

This method of construction is much more certain than the method of building and sinking the curb as the excavation progresses, but is more expensive, the circular dam requiring a large amount of lumber to construct it. After a careful estimate of the cost of the lumber, the excavation of the dam and of the interior of the reservoir and the refilling of the latter, the extra cost of constructing the wall from the bottom of the trench upward, the cost of pumping, and deducting the estimated cost of the iron shoe, it was decided that $2,000 was a fair allowance, and the payment of that amount was recommended as being most economical and advantageous to the Government, as it insured a better constructed reservoir at reasonable cost and avoided the risk attendant upon the other plan. Though the risk is the contractor's so far as payment is concerned, the risk of delay in completion of this important work should be avoided, if possible, by the Government.

Authority was therefore asked to enter into a supplemental contract with Mr. Rosser whereby he agreed to do the extra work outlined above for the sum named, viz, $2,000, and this authority having been granted, the papers were prepared and signed, and approved May 13, 1895.

The actual work of laying sewer pipe was commenced on April 22, 1895, and at the close of the fiscal year the following amount of work had been completed:

Six-inch sewer pipe laid	linear feet	1,408.6
Eight-inch sewer pipe laid	do	2,982.8
Manholes completed	number	15
Extra concrete put in place	cubic yards	10.31
Extra brick masonry	do	0.25

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The Engineer workshop has been removed from the site of the sewage reservoir to its permanent location, but the brick foundation has not yet been rebuilt.

As was anticipated in paragraph 39 of the specifications, the progress of work has been slow and its excavation very difficult on account of the large amount of ground water entering the trenches, necessitating the sheet piling of almost the entire trench so far opened. The constant flow of ground water into the trench, when the bottom of the latter was at an average reference of mean low water, varied from 1½ to 2 gallons per second per 75 feet of trench.

As practically little or no surface drainage exists for the interior of the fort, the disposal of the water pumped out of the trenches has been a constant source of care. Owing to the unavoidable flow of water along its bottom, it was soon found impossible to make tight joints without elevating the pipe above this water. This has been successfully done by excavating the ditch about 5 inches below grade and resting the pipe on wooden blocks 4 by 6 by 12 inches, laid at right angles to the axis of the sewer. To secure tightness of joints and reduce the number of joints to be made in the trench, two 3-foot lengths of pipe are jointed in vertical frames on the bank two or three days before being used, giving practically a 6-foot length of pipe and reducing by half the number of joints to be made in the trench.

Money statement.

Amount appropriated by act of August 1, 1894		$37,500.00
Amount assessed on nonmilitary residents, as per table		22,432.50
Amount available of appropriation of August 1, 1894		22,432.50
		44,865.00
June 30, 1895, amount expended during fiscal year		3,898.10
July 1, 1895, balance unexpended		40,966.90
July 1, 1895, outstanding liabilities	$308.00	
July 1, 1895, amount covered by uncompleted contracts	35,398.00	
		35,706.00
July 1, 1895, balance available		5,260.90

SAN FRANCISCO HARBOR.

Batteries in the charge of Col. G. H. Mendell, Corps of Engineers, with First Lieut. C. A. F. Flagler, Corps of Engineers, as assistant until August 6, 1894, and First. Lieut. J. E. Kuhn, Corps of Engineers, since that date.

Gun emplacements.—It appearing to be difficult, if not impracticable, owing to its width, to set the roller path of the carriage reliably in lead, as was done in the case of the mortar carriages, it was set by first supporting it accurately to its level on wedges and then underpinning it with rich Portland cement mortar, mixed with a minimum of water, ramming with the care necessary to secure a continuous bearing. It is thought that the same practice may, with propriety and economy, be used on the mortar platforms.

The concrete in the 12-inch gun platform is made of one of the best Portland cements, with clean, coarse, and fine sand in mixture, and the best obtainable solid materials of stone and gravel, 1 yard to the barrel. It was necessary to excavate for foundation, so that the depth of the platform is 13 feet. The foundation is in yellow clay, which yields readily when wet. Owing to this condition particular care was used to

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drain the foundation. The circumference of the lower plane of the concrete was surrounded by an open drain of concrete covered with gravel, which removes any water that might, if not removed, impair the resistance of the ground.

The masonry contains several tons of street-car cable arranged in circular folds and of old street-car rails disposed in horizontal and vertical lines. A blue print showing the details has been furnished to the Department.

The neck of the roller path was filled with concrete, giving additional power of resistance, and relieving to a certain extent the hold-down bolts of aluminium bronze. The connection of this concrete with the mass of the platform was strengthened by the placing of two old gun pintles vertically, and facing them with an iron plate.

It was the intention to give this platform all the strength obtainable at no great expense. At the date of expected test the concrete will have age to give not far from its maximum tensile strength.

During the year drawings of the platform for emplacement No. 16 were received, which enabled the emplacement to be finished. In detail, the following work was done: The gap left in the parapet was filled in with 157 cubic yards of concrete, a circular recess 2 feet 6 inches deep having been first cut away to receive the platform. A concrete landing 6 by 8 feet was built in front of the magazine door. The floor of this landing is 1 foot below the level of the terreplein and divided from it by retaining walls 1 foot high. A curved ramp 4 feet wide, slope $^1/_{10}$, connects the landing with the terreplein, up which the shot truck will pass. A concrete foundation averaging 8 inches thick was laid upon the superior slope for a distance of 25 feet from the muzzle of the gun and between the limiting horizontal angles of fire. This is to be covered with 3 inches of asphalt as a protection against the blast. The terreplein was filled in to grade and covered with about 6 inches of macadam. A ramp of $^1/_8$ and 8 feet wide was built around the left end of the terreplein, connecting it with the road in rear of the emplacement. This road was extended a short distance to the left flank of the emplacement. A flight of eleven concrete steps 6 feet wide was also built to connect the terreplein with the road.

During the month of June drawings for 10-inch guns on disappearing carriages were received, and work was at once begun upon the platforms. The foundations for the platforms were explored by digging trenches in emplacements Nos. 13, 12, and 11, and the excavations in emplacements 13 and 12 partly made. A concrete bed was prepared at emplacement 13 and a derrick for hoisting concrete partly rigged.

Mortar Battery No. 1.—The parade in rear of pit No. 4 was filled in to grade, being given a gentle slope from the edges of the concrete floor of the pit. The west traverse was filled in and top-dressed. The ground around the south, west, and north sides of the battery was given a back slope of $^1/_{15}$ from the crest of the battery slopes for a width of 30 feet to a drain which cuts off all surface water flowing toward the battery. This drain falls in both directions from in front of pit No. 1, and discharges into natural ravines on the east side. This drain is an open concrete gutter, except 490 feet at the south end, which is made of oval-shaped sewer pipe, 16 by 20 inches in cross section, laid in a trench. The total length of the drain is 1,425 feet. The concrete plant was taken down and removed and the cut leading to the mixer filled in and the site graded off.

A roadway was built from McDowell avenue, from a point in rear of emplacement No. 13, past the north and around the east side of the

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battery, where it terminates in the parade in rear of pit No. 4. This roadway is 2,000 feet long, 18 feet wide, and covered to an average depth of 8 inches with macadam. The road is provided with side gutters, and is crossed by three sewer-pipe culverts. The parade and roadway connecting pits Nos. 2 and 4 were covered with about 6 inches macadam. All macadamized surfaces were sprinkled and rolled. All of the foregoing work had been completed in October, 1894, and the earthwork of the battery practically finished.

During December, 1894, and January, 1895, the rainfall was unusually heavy and continuous. The loam covering of the newly built slopes in pits Nos. 1 and 2 and of the roadway between pits Nos. 2 and 4 became saturated with water, and in January a slide amounting to more than 1,000 cubic yards occurred. This loam covering had been borrowed from the surrounding ground and deposited upon the slopes to an average depth of 20 inches to support a growth of grass. This soil is very rich, but resembles a sponge in its capacity of absorbing and retaining water. Before the rainy season set in gophers and moles had honeycombed the slopes, facilitating the entrance of water. The increasing downpour of rain gave the loam no opportunity for drying out, and it was eventually reduced to an almost semi-fluid state, which caused it to literally flow from the slopes.

More than 200 cubic yards fell in pit No. 1, and more than 800 cubic yards fell in pit No. 2 and in the roadway between pits Nos. 2 and 4. The drainage of pit No. 1 was fortunately kept open and no harm done to the mortars mounted in this pit, but in pit No. 2 the drainage was completely closed and the platforms in progress of erection entirely buried under mud and water.

The fallen material was attacked at once at the only point where it could be reached, namely, the roadway. The confined space in which it was necessary to work and the character of the material handled made the work necessarily slow. By the end of February the fallen material had all been removed and the pits cleaned out. The damaged slopes were then restored. As the cause of the accident was the retention of the water by the loam, care was taken to provide for its escape. Before the loam covering was replaced the clay slopes were benched, and in the benches blind drains were laid, discharging into the nearest convenient outlet. Two benches were made in the length of a slope. Instead of using loam only for backfilling it was mixed with about equal parts of fine sand, obtained from some sand heaps south of the battery. The damaged slopes in pits Nos. 1 and 2 were sodded, those in the roadway being top dressed and sown with oats as before. A low concrete retaining wall and gutter was built at the foot of the magazine slope of the roadway, behind which was made a blind drain discharging through weepers into the gutter. A similar blind drain was laid in rear of the gutter already built on the other side of the roadway. A layer of sod was placed at the foot of each slope of the roadway. The damaged slopes were all restored by June, 1895.

The floor of the western passageway was finished in sidewalk finish. The floors of the four pits and of the sixteen platform pits were similarly finished. The total amount of floor finish for the year amounted to 8,526 square feet. The concrete steps leading to pit No. 1 were finished and plastered. Slight repairs were made to retaining walls and floors of passageways. For drainage there were built 322 linear feet of concrete retaining wall and gutter, 1,135 linear feet of open gutter at the foot of the back slope, and 526 linear feet of sewer.

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A picket fence 7 feet high was built entirely around the battery. Its total length is about 1,900 feet. It is provided with two wagon and three foot gates. The fence is made of 4 by 6 inch redwood posts spaced 8 feet apart, with three stringpieces, the top one 2 by 6 inches, the others 3 by 4 inches. The pickets are 4 inches wide, with 2-inch intervals. A 1-by-12-inch baseboard is placed at the bottom of the pickets. The stringers and pickets are of Oregen pine, the baseboard of redwood. The fence has been covered with a dull-red lime wash.

The firing cable, obtained upon requisition from Willets Point, was passed through the firing pipe, and the switch board, firing, and testing instruments installed in the firing rooms. Both the firing apparatus and the electric-light plants have been tested during the year with entire success. All the mortars in pit No. 1 have been fired with satisfactory results. Wooden storm doors have been hung at the entrance to the passageways to keep out dust and water. The various sheds used in the construction of the battery have been removed and the entire battery policed. All gates and doors have been provided with brass padlocks.

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APPENDIX No. 2.

REPORT BY COL. HENRY L. ABBOT, CORPS OF ENGINEERS, BVT. BRIG. GEN., U. S. A., UPON VOLLEY PRACTICE WITH MORTARS.

NEW YORK CITY, *February 2, 1895.*

GENERAL: In testing the mortars and carriages forming the armament of the mortar battery recently completed by Lieut. Col. G. L. Gillespie, Corps of Engineers, certain firing has recently been made by the Ordnance Department which throws valuable light upon the probable accuracy of fire when served in volleys from separate pits. I have subjected this firing to the usual tests of precision, independent of errors of pointing, and now inclose a table showing the results, which I think will prove interesting to the Engineer Department.

The firing was done from the northwest pit, and from the southeast and southwest pits, and was usually directed seaward. The points of impact were fixed by triangulation from a base line about 5 miles long, which was sufficient to give good intersections to determine points of fall. Prior to each volley a single shot was fired, usually from the northeast pit, with a setting corresponding to that of the volley, to enable the observers to set their instruments approximately. The jets of water were sufficiently high to accurately fix these points of impact.

In discussing the results I have computed the width of the 50 per cent zones by multiplying the mean distance from the central point of fall (longitudinally and laterally in turn) by 1.69, the usual mode of discussing such observations. The results are given in the accompanying table.

Two volleys were fired down the beach and the points of impact were accurately determined by a survey. These results are given in a separate table herewith. The exact precision of these shots admits of no doubt.

There were several other volleys fired which, if desired, can be furnished, but I have selected those where the precision of the triangulation admits of check, all the circumstances being identical. In the last four volleys fired from the southwest pit there was a variation of about two pounds of powder in two of the four shots. In determining the variation in range a correction of 100 yards has been applied additively to the ranges for the smaller charges in order to reduce the results to what would have been had uniform charges of powder been employed.

The excellent results obtained by this firing demonstrate that all which has been expected from volley firing has been secured, and that the practice should be continued down the beach with projectiles so marked as to show from which mortar each was fired, in order to place the results beyond cavil.

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SHOTS FALLING IN WATER.

Pit.	Number of shots.	Elevation.	Shell.	Charge.	Range.	50 per cent zones.		25 per cent prob. rect.	Remarks.
						Lateral dispersion.	Longitudinal dispersion.		
		°	*Lbs.*	*Lbs.*	*Yards.*	*Yards.*	*Yards.*	*Sq. yds.*	
Northwest	3	45	635	78	9,760	57	135	7,774	One shot lost.
	3	45	635	78	9,760	32	51	1,627	Do.
	4	45	635	78	9,792	51	57	2,913	
Means					9,770	47	81	4,105	
Southeast	4	45	802	76	8,783	24	167	3,965	
	4	45	806	76	8,816	32	74	2,888	
	3	45	806	76	8,785	12	110	1,296	One shot lost.
Means					8,795	23	117	2,550	
Southwest	4	60	806	74	7,022	32	56	1,791	
	4	60	806	74	7,115	13	58	776	
	4	60	806	74	7,201	12	15	179	
Means					7,113	19	43	915	

SHOTS FALLING ON BEACH.

Southwest	4	60	802	29	3,070	13.5	13.5	172	
	3	60	806	62	6,196	11.8	20.3	240	One shot lost.

Very respectfully, your obedient servant,

HENRY L. ABBOT,
Colonel of Engineers, Bvt. Brig. Gen., U. S. A.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

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APPENDIX No. 3.

POST OF WILLETS POINT, NEW YORK—UNITED STATES ENGINEER SCHOOL—BATTALION OF ENGINEERS—ENGINEER DEPOT.

REPORT OF LIEUT. COL. W. R. KING, CORPS OF ENGINEERS, FOR THE FISCAL YEAR ENDING JUNE 30, 1895.

UNITED STATES ENGINEER SCHOOL,
Post of Willets Point, New York Harbor, July 1, 1895.

GENERAL: I have the honor to forward herewith duplicate annual report on the post of Willets Point, New York Harbor; the United States Engineer School; the Battalion of Engineers, and the Engineer Depot, for the fiscal year ending June 30, 1895.

Very respectfully, your obedient servant,

W. R. KING,
Lieutenant-Colonel of Engineers, Commanding.

Brig. Gen. W. P. CRAIGHILL,
Chief of Engineers U. S. A.

I.—POST OF WILLETS POINT, N. Y.

At the close of the fiscal year the garrison consisted of 21 commissioned officers and 390 enlisted men, including the following general staff and infantry officers:

Maj. Egon A. Koerper, surgeon, U. S. Army.
Capt. Nathan S. Jarvis, assistant surgeon, U. S. Army.
First Lieut. Charles McQuiston, Fourth Infantry.
Second Lieut. Hiram McL. Powell, Second Infantry.
Second Lieut. William P. Jackson, Twenty-fourth Infantry.

The following table shows the changes among the general staff and line officers at the post during the year:

Rank and organization.	Name.	Date.	Relieved or joined.
Second lieutenant, Third Artillery	Hamilton, James	Oct. 1, 1894	Relieved.
Second lieutenant, Thirteenth Infantry	Fox, Joseph C	do	Do.
Second lieutenant Twenty-fourth Infantry	Jenks, Isaac C	do	Do.
Second lieutenant Sixteenth Infantry	Woodward, John E	do	Do.
Second lieutenant Nineteenth Infantry	Ronayne, James	do	Do.
First lieutenant, Fourth Infantry	McQuiston, Charles	Dec. 1, 1894	Joined.
Second lieutenant, Second Infantry	Powell, Hiram McL	Nov. 30, 1894	Do.
Second lieutenant, Twenty-fourth Infantry	Jackson, William P	do	Do.

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QUARTERMASTER AND SUBSISTENCE DEPARTMENTS.

These departments have, during the past year, been in charge of First Lieut. Edgar Jadwin, Corps of Engineers.

The new barrack building for Company A has been completed and occupied. The work of rehabilitation of Quarters No. 10 has been completed. Quarters Nos. 4 and 5, which stood on the parade ground in front of C company barracks, were moved across the road to the site at the southern end of the line of quarters on the west side of the parade ground. Quarters Nos. 6 and 7, which also stood in front of C company barracks, were moved diagonally across the parade ground to the site at the northern end of the line on the east side of the parade ground.

Both buildings were completely renovated and painted, and have been occupied since last fall.

The removal of the above buildings has enlarged the parade ground about 50 per cent.

New macadamized roads have been built along the eastern and southern sides of the parade ground, making the latter rectangular.

The old barrack buildings Nos. 21 and 23 have been torn down.

A large quantity of the concrete used in the foundations of the above barracks and quarters has been broken into blocks and used in continuing the work on the retaining wall at the ice pond. This wall is now approaching completion.

Much of this old concrete has also been used as riprap on the shores of the post to check erosion by the waves.

The usual minor repairs, such as carpentering, painting, glazing, roofing, plastering, and repairs to heating apparatus, have been made to the barracks, quarters, and storehouses of the post proper.

The sidewalk along the main road leading into the post has been paved for about 750 feet of its length. Brick are now on the ground for paving the remaining 225 feet.

The brick paving has been extended along the west side of the road in front of quarters Nos. 4 and 5. Brick are now on the ground for completing the paving along the east side of the same road and for starting that on the new sidewalk being built on the east side of the parade ground. A cinder sidewalk has been built along the upper side of the road extending from headquarters past the married soldiers' quarters to the quartermaster storehouse.

A line of shade trees has been planted along the east side of the parade.

The necessary repairs have been made to the water and sewer systems.

A large supply of ice was stored during the winter.

Last summer was a good one for most of the crops in the post garden. The present one bids fair to be even better.

The routine duties of the departments connected with policing, transportation, fatigue, and the issue and sale of clothing and subsistence supplies have been carried on in the usual manner.

Allotments are urgently recommended for the construction of a new quartermaster and commissary storehouse and of a new mess hall.

In several former reports recommendation has been made that headstones be provided for the graves of soldiers buried at this post. Many of the wooden headboards are going to decay, and although some of the graves are marked by marble slabs erected by comrades, there are still a number of graves not properly marked.

The most important pieces of work now requiring the attention of the fatigue party are the grading of the parade and cleaning out of the ice pond.

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II.—UNITED STATES ENGINEER SCHOOL.

The scope and object of the school have been fully set forth in previous reports and in the order establishing it on its present basis. The orders issued in pursuance of the latter, arranging the details of the season's work, are appended, marked A, B, and C.

During the present year a class of two engineer officers completed the full course of two and one-half years, and five line officers completed their course of torpedo instruction.

THIRD WINTER'S CLASS—(COURSE COMPLETED).

Second Lieut. James B. Cavanaugh, Corps of Engineers.
Second Lieut. James P. Jervey, Corps of Engineers.

SECOND WINTER'S CLASS.

Second Lieut. George P. Howell, Corps of Engineers.
Second Lieut. Charles W. Kutz, Corps of Engineers.
Second Lieut. Meriwether L. Walker, Corps of Engineers.
Second Lieut. Robert P. Johnston, Corps of Engineers.
Second Lieut. Robert R. Raymond, Corps of Engineers.

FIRST WINTER'S CLASS.

First Lieut. Charles McQuiston, Fourth Infantry.
Second Lieut. Hiram McL. Powell, Second Infantry.
Second Lieut. William P. Jackson, Twenty-fourth Infantry.
Second Lieut. William B. Ladue, Corps of Engineers.
Second Lieut. William J. Barden, Corps of Engineers.

III.—BATTALION OF ENGINEERS.

The law provides for five companies of engineer troops, having an aggregate strength of 752 enlisted men, officered by details from the Corps of Engineers.

At present only four companies, with a total strength of 500 enlisted men, are allowed to be recruited.

The aggregate strength of the battalion of engineers on June 30, 1895, including Company E, stationed at West Point, N. Y., was 19 commissioned officers and 470 enlisted men.

During the year Companies A, B, and C have been stationed at Willets Point; Company D exists in name only; Company E has been stationed at West Point to assist in the practical instruction of cadets of the Military Academy, in building military bridges, sapping, mining, and signaling.

The following is a roster of officers serving with the battalion of engineers on June 30, 1895, viz:

Lieut. Col. W. R. King, Corps of Engineers, commanding.
Second Lieut. Jay J. Morrow, Corps of Engineers, adjutant.
First Lieut. Edgar Jadwin, Corps of Engineers, quartermaster.
Company A:
Capt. Walter L. Fisk, Corps of Engineers, commanding company.
Second Lieut. Meriwether L. Walker, Corps of Engineers, with company.
Second Lieut. Robert R. Raymond, Corps of Engineers, with company.
Second Lieut. William J. Barden, Corps of Engineers, with company.
Company B:
Capt. William T. Rossell, Corps of Engineers, commanding company.
Second Lieut. James B. Cavanaugh, Corps of Engineers, with company.
Second Lieut. George P. Howell, Corps of Engineers, with company.
Second Lieut. William B. Ladue, Corps of Engineers, with company.
Company C:
Capt. William M. Black, Corps of Engineers, commanding company.
Second Lieut. John S. Sewell, Corps of Engineers, on detached service.

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Company C—Continued.
Second Lieut. James P. Jervey, Corps of Engineers, with company.
Second Lieut. Charles W. Kutz, Corps of Engineers, with company.
Second Lieut. Robert P. Johnston, Corps of Engineers, with company.
Company D:
Exists in name only.
Company E:
Capt. James L. Lusk, Corps of Engineers, commanding company.
First Lieut. Mason M. Patrick, Corps of Engineers, with company.
Second Lieut. Charles M. Bromwell, Corps of Engineers, with company.

The following table shows the changes that have taken place in the personnel of the officers during the year:

Rank.	Names.	Date.	Joined or relieved.	Remarks.
Second lieutenant..	Ladue, William B.....	Sept. 30, 1894	Joined....	Special Orders, 165, Adjutant-General's Office, July 16, 1894.
Second lieutenant..	Barden, William B....	.....do	.....do	Do.

RECRUITING, DISCIPLINE, ETC.

During the year recruits for the battalion have been obtained by enlistments at Willets Point and West Point, from the recruiting rendezvous at Davids Island and Columbus Barracks, and by assignment on their own application from other branches of the service.

The engineer sergeant detailed to recruit for the Battalion of Engineers on February 17, 1893, and attached by the superintendent of the recruiting service to rendezvous 146 Park Row, New York City, was relieved from that duty on August 19, 1894, 28 recruits only being required to complete the battalion.

The following is a statement of changes among the enlisted men of the battalion during the past year:

Gain:	
Recruits from depot	57
Enlisted in battalion (Willets Point, 24; West Point, 18)	42
Reenlisted (Willets Point, 42; West Point, 8)	50
By transfer	1
From desertion	4
Total gain	154
Loss:	
Discharged by expiration of service	52
Discharged for disability	1
Discharged by sentence of general court-martial	4
Discharged by special order	5
Discharged by General Orders, No. 80, Adjutant-General's Office, series 1890.	43
Discharged by General Orders, No. 81, Adjutant-General's Office, series 1890.	9
Transferred	14
Retired	5
Dropped from the rolls	2
Died of disease, etc	5
Deserted	12
Total loss	152

This result shows a net gain of 2 men, which increases the battalion to within 30 men of its authorized strength.

During the fiscal year ending June 30, 1895, 72 men of the battalion of engineers were entitled to be discharged under the provisions of

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paragraph 2, General Orders No. 80, Adjutant-General's Office, 1890, 42 of whom availed themselves of this privilege.

Seventy-nine enlisted men were on furlough during the year under the provisions of General Orders No. 80, Adjutant-General's Office, 1890.

The following table gives a comparative statement of recruiting, desertions, etc., during the past ten years:

Fiscal year.	Recruiting.		Average daily number.		Deserted.	Trials.			No. of men on June 30.
	Enlisted.	Reenlisted.	Arrest or confinement.	Sick.		General court-martial.	Garrison court-martial.	Summary court.	
June 30, 1885, to June 30, 1886...	57	38	8	22	76	20	107	.....	395
June 30, 1886, to June 30, 1887...	20	28	9	17	49	19	160	.....	388
June 30, 1887, to June 30, 1888...	9	24	12	22	49	21	218	.....	387
June 30, 1888, to June 30, 1889...	90	29	6	20	23	4	214	.....	402
June 30, 1889, to June 30, 1890...	147	64	9	14	52	13	304	.....	468
June 30, 1890, to June 20, 1891...	50	59	6	12	15	12	60	138	417
June 30, 1891, to June 30, 1892...	83	42	5	10	24	19	4	208	437
June 30, 1892, to June 30, 1893...	63	31	6	11	17	18	8	156	418
June 30, 1893, to June 30, 1894...	111	39	6	13	25	27	4	125	466
June 30, 1894, to June 30, 1895...	42	50	4	10	12	3	7	194	470

This table shows that the enlisted strength of the battalion was greater than at any corresponding period during the last ten years, while the per cent of men sick, in arrest or confinement, deserted or tried by general court-martial, was less than during any other of the ten years.

The following statement shows the number of different men tried by court-martial and other facts relative to the trials:

	Number of men.	Number of trials.
Tried once	73	73
Tried twice	33	66
Tried three times	8	24
Tried four times	9	36
Tried five times	1	5
Total	124	204

Number of men who pleaded guilty	173
Number of men who pleaded not guilty	31
Total	204
Number of acquittals	7
Number of men found guilty	197
Total	204

DRILL AND INSTRUCTION.

During the year the battalion of engineers has been drilled and instructed as follows:

1. Infantry tactics: School of the soldier, company, and battalion.

2. Target practice: The target practice for the post of Willets Point, N. Y., for the past year was from July 2, 1894, to August 16, 1894, and at West Point during the month of June, 1894.

Owing to the objections by the citizens living in the vicinity to the use of the rifle range at this post, no regular target practice could be had. A suitable butt, with targets for firing at short ranges and with reduced charges, built at this post in 1891, was kept thoroughly repaired.

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Target practice was held daily by companies in turn, superintended by the company commanders.

3. Pontoniering during the months of August, September, and October, 1894.

4. Military engineering: Foot reconnaissance, tracing, profiling, and construction of trench material and field fortifications, sapping and mining during the months of October. November, and December, 1894; construction of spar bridges, double lock, including knots and lashings, during the months of September and October, 1894.

Theoretical instruction in military engineering during the months of March and April, 1895.

5. Torpedo drills were had throughout the year, the winter months being devoted to indoor drills and practice in the loading room, and the summer months to outdoor drills and exercises.

The following number of men received instruction during the winter months, viz, 24 sergeants, 30 corporals, and 303 privates.

Four sergeants and 2 corporals of Company E, battalion of engineers, were, in detachments of two each, assigned for instruction in torpedo service under authority granted in letter dated Adjutant-General's Office, August 3, 1893.

Qualification of privates:	
First class	228
Second class	75
Total	303

Six men received no instruction during indoor season, viz: 4 men sick in hospital (2 of whom have since died; 1 was transferred to Government Asylum at Washington; 1 was transferred to Army and Navy General Hospital, Hot Springs, Ark.), and 2 men about to be retired.

During the summer season of 1894 10 grand groups were planted, which required 10 different details by roster, each detail consisting of 2 commissioned officers, 3 noncommissioned officers, and 12 privates.

Three grand groups have been planted this summer to and including June 30, requiring 3 different details of the same size as above.

6. Photography: Selected details of noncommissioned officers have been instructed in military photography.

7. Military signaling: The noncommissioned officers have been instructed in military signaling during the months of March and April, 1895.

8. In order to facilitate the learning of the various industrial trades by enlisted men, and furnish men qualified for special duty as carpenters, blacksmiths, engine drivers, etc., a detail of 12 men were employed under the supervision of Lieut. James B. Cavanaugh, Corps of Engineers, to act as assistants to the mechanics at work in the different shops on the post, when not on other duty. This duty was voluntary, and the men were allowed to select the trades they were to learn. If they made satisfactory progress they were considered eligible for special details when vacancies occur, but if not they were replaced by others, and a record was kept of the progress made by each man for future reference.

9. The post schools for the enlisted men and for the children living on the post were under the supervision of Lieut. James B. Cavanaugh, Corps of Engineers, and have been well conducted. Forty-two enlisted men and 63 children between the ages of 5 and 15 have received appropriate instruction.

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ENGINEER DEPOT.

BUILDINGS, BOATS, ETC.

I. A substantial shed has been built over the cable tanks, and the frame has been so constructed as to support traveling cranes with powerful winches which can reach any part of the tanks and remove any drum of cable and deposit it on a truck alongside the tanks.

II. The supply of bridge equipage has been increased by the purchase of as much material as the funds available would permit. The additions include the following: Twenty-six canvas pontoon boats complete with boxes and covers, 2 wooden pontoon boats, materials for 8 sets of bridge trestles, 120 pieces timber for long balk, and a large quantity of manila rope, paints, oils, cotton waste, lumber, timber, etc.

III. The long frame building in which all the pontoon wagons and much other property are stored has been cut in two near the middle, and two brick partition walls have been built as a precaution against loss by fire.

IV. Several valuable additions have been made to the collection of engineer models, and the library of the Engineer School has been increased by the purchase of such professional books of recent date, and current scientific publications, as the appropriation would justify. It is to be regretted that no provision was made for this important matter in the last appropriation bill.

V. The usual repairs to buildings and property of the depot have been made by enlisted men of the engineer battalion detailed for the purpose.

VI. The coal shed near the Long Wharf, in which the depot coal is stored, was repaired, some of the posts supporting this structure have been replaced, and the roof of the same, which was never replaced since it was built in 1886, will be covered with galvanized corrugated sheet iron, which was procured before the close of the present fiscal year.

DEPOT PROPERTY AND WORK OF DEPOT.

I. The contracts for submarine mining armored cable made with the Chicago Electric Wire Company, of Delaware, have at last been completely filled, and the * * * cable, single and multiple, has been tested and accepted. It is believed that this cable, which is the first large quantity procured from American manufacturers, is equal to any that has been procured abroad, and the price was extremely low for that quality of the cable. * * *

II. A large quantity of other materials for submarine mining has been procured, and the entire amount of the appropriations available has been expended. A complete list of these materials was forwarded to the Department with my letter of April 26, 1895, and this list shows the kind, quantity, cost, and location of every article.

In procuring these materials and appliances, which embrace several hundred different kinds, and which have cost some $400,000, every effort has been made to secure the best quality and workmanship, and in nearly every case they have been furnished or manufactured by the most reputable dealers or makers of each particular class of goods. At the same time a wholesome competition has been invited and secured in all possible cases, and the prices paid have been so reasonable as to bring the cost, some $60,000, within the estimates and allotments. * * *

III. Another submarine cable was procured and laid between Forts Wadsworth and Hamilton, for use of the "Board on Control of Artillery Fire," and was paid for from an allotment made by the Board of Ord-

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nance and Fortification. This cable had three insulated cores, and was heavily armored. So far as known, it has answered the purpose for which it was laid.

IV. The Sims-Edison torpedo referred to in former reports, and which was accepted in August, 1893, was tested with a view to ascertaining the best form of motor for the two torpedoes purchased several years ago without motors. As the plans for these new motors had not been fully decided upon at the end of the year, the torpedoes have not been completed.

INSTRUMENTS.

The various kinds of instruments on hand in the depot have been properly cared for. Some additions have been made by purchase, and the work of issuing, receiving, repairing, and cleaning was continued.

I. Received by purchase during the year under formal proposals, viz:

Five engineer transits, 2 engineer levels, 6 level rods, 13 hand levels, 15 odometers, 6 binocular field glasses, 10 100-foot surveyors' chains, 10 sets of chain pins, 20 pocket compasses, 6 50-foot metallic tapes, 6 horn protractors, 7 sets of drawing instruments, 3 clinometers, 20 Abbot's protractors, 12 triangular scales, 24 rubber rulers, 12 chronograph pens, 1 voltmeter, 1 ammeter, and 1 tracking instrument.

II. Issues to officers of the Corps of Engineers and to acting engineer officers at department headquarters during the year were as follows:

Five engineer transits, 3 theodolites, 5 engineer levels, 14 hand levels, 3 gradienters, 1 pantograph, 1 magnetometer, 1 dip circle, 1 reducing square, 4 prismatic compasses, 4 triangular scales, 7 sets of drawing instruments, 4 protractors, 12 pocket compasses, 2 pedometers, 2 clinometers, 5 level rods, 3 50-foot metallic tapes, 6 surveyors' chains, 6 sets chain pins, 9 thermometers, 6 aneroid barometers, 6 binocular field glasses, and 1 photographic camera, with plate holders, etc., complete.

There were also issued during the year quite a number of various instruments to surveying parties, details from the Engineer battalion, for the purpose of making instrumental surveys of certain portions of the island, and for hydrographic surveys of portions of the Long Island Sound in the vicinity of this post. These instruments, upon being returned, are overhauled and cleaned in the depot instrument shop and then returned to the fireproof storehouse.

III. Receipts of instruments from officers of the Corps of Engineers on public works and surveys and from acting engineer officers during the year were as follows:

Six engineer transits, 4 theodolites, 2 artificial horizons, 5 rod levels, 13 sets drawing instruments, 7 heliotropes, 1 zenith telescope, 2 telescopes, 3 sextants, 4 binocular field glasses, 4 prismatic compasses, 3 mercurial barometers, 9 odometers, 5 steel tapes, 2 hand levels, 6 aneroid barometers, 5 chronometers, 3 level rods, 10 thermometers, 6 sets chaining pins, 2 pocket compasses, and 1 case of tools for repair of barometers.

Most of the above-named instruments were returned from the International Boundary Survey between the United States and Mexico, where they have been in use for several years, and some of them are now not worth repairing and will be submitted for inspection and condemnation.

IV. Repairs to instruments.—All of the repairing to depot instruments has been performed by enlisted men of the Engineer battalion detailed on extra duty for the purpose. The following have been overhauled and repaired in the depot repair shop, viz:

Ten engineer transits, 1 theodolite, 16 prismatic compasses, 2 100-foot steel tapes, 22 aneroid barometers, 3 current meters, 2 sets drawing instruments, 1 switch board, 1 chronograph timer, 4 chronometers, 2 dial telegraph instruments, 1 magnetometer, 1 dip circle, 15 odometers, 4 hand levels, 2 binocular field glasses, and one typewriter; also a number of other smaller instruments, tools, and electrical appliances.

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V. The following instruments pertaining to headquarters department of Dakota were repaired at St. Paul, Minn., and the cost of repairing paid for from this office under authority of the Chief of Engineers, U. S. A., viz:

Two engineer transits, 8 odometers, and 4 prismatic compasses.

EXPERIMENTS.

Several of the experiments made during the year have been reported from time to time, and others have been placed on record for further study.

During the exceptionally cold weather in February an opportunity was afforded to make some tests of several kinds of explosives in breaking up ice, which was quite thick, and the results showed that any attempt to remove ice in large quantities, as for example to improve navigation by means of explosives would be quite an expensive and tedious operation. A result which tallies with numerous recent experiments in France and Germany.

In order to utilize the armor of the large quantity of submarine cable that has become unfit for use on account of deterioration in the insulation, a very simple and inexpensive machine was improvised, and from preliminary tests, which were all there was time to make, it was found that the armor wires can be taken off and coiled on spools at the rate of 6 feet of cable per minute, giving over half a mile of wire per hour; the reel being turned by hand power. It is thought that with some slight changes and using steam power a very much faster rate may be attained.

In jointing cable the ordinary method of using brass tube jointers is a clumsy method, while the McIntire jointer is too expensive and makes too large a joint. To obviate this a modified form of pliers has been tested, which gives excellent results and is no more expensive or difficult than the simplest form heretofore tried.

Several runs and dock trials of the Sims-Edison torpedo have been made and the results have been reported in detail.

For the purpose of testing the steering mechanism, two runs were made with a soldier, Private Muller, seated on the float.

The dock trials were generally made to test the static traction of the torpedo with different forms of propeller.

There were also quite a number of trials of the motor with a dynamometer to test the electrical elements of the system.

* * * * * * *

In order to track vessels in connection with the torpedo service a suitable instrument has been very much needed, and, after experimenting with an improvised binocular instrument, a new instrument, designed by me and made by Messrs. W. & L. E. Gurley, has been tried with very promising results. It is believed that in many respects it is the best form of tracking instrument that has been tried, and that with such detailed improvements as actual service will suggest it will answer all purposes of such an instrument.

The pressure gauge described in the Annual Report of the Chief of Engineers for 1889, page 479, has been improved by inserting a circuit-closing spring in the compressible bag, so that when the pressure from the explosion is greater than that of the compressed air in the bag, contact will be made and indicated on a small galvanometer. It is believed that this method will enable the pressures of explosions to be measured at great distances from the origin, and thus give the neces-

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sary data from which the law of diminution of the energy of explosions may be ascertained. A drawing showing the improved form is appended herewith and marked D.

Other experiments of minor importance were made, such as the testing of several explosives, building materials, alloys of bismuth, lead, etc., for high electrical resistances, and of cable to ascertain its conductivity and insulation resistance.

* * * * * * *

ESTIMATES.

There will be required for the fiscal year ending June 30, 1897, the following for the Engineer Depot at Willets Point, N. Y.:

1. For incidental expenses of depot, including fuel, light, chemicals, stationery, hardware, extra-duty pay to soldiers necessarily employed for periods not less than ten days as artificers on work in addition to, and not strictly in the line of, their military duties, such as carpenters, draftsmen, blacksmiths, printers, photographers, lithographers, engine drivers, wheelwrights, masons, teamsters, painters, machinists, overseers, and laborers, and for materials to repair public buildings, machinery, and unforeseen expenses	$5,000.00
2. For purchase of materials for the instruction of engineer troops at Willets Point, N. Y., in their special duties of sappers and miners, for land and submarine mines, pontonier and torpedo drill, and signaling, and for purchase of and for forage for one team draft horses required in ponton, sapping, and mining instruction	1,500.00
3. For purchase and repair to instruments to be issued to officers of the Corps of Engineers, and to officers detailed on duty as acting engineer officers, for use on public works, surveys, and reconnoissances	3,000.00
4. *For Library of Engineer School*: For purchase and binding of professional works of recent date, treating of military and civil engineering and kindred scientific subjects	500.00
Total	10,000.00

APPENDIX A.—PROGRAMME OF STUDY AND INSTRUCTION FOR SUMMER SEASON.

[Printed Orders, No. 112.]

UNITED STATES ENGINEER SCHOOL,
Willets Point, New York Harbor, May 23, 1894.

The following programme of study and instruction for the ensuing summer season, to commence June 4 and end November 30, 1894, having been recommended by the academic staff and approved by the Chief of Engineers, will be carried into effect.

A roster of the student officers will be kept by the post adjutant, who will make weekly details for the various duties so that they shall not conflict.

I.—MILITARY ENGINEERING.

1. Practical instructions in the nomenclature, dimensions, and construction of modern field and siege batteries and saps. Also practical instructions in the location of works on irregular ground and the adaptation to site.
2. A full course of trestle and pontoon bridge drill.
3. Instruction in building spar bridges.
4. Instruction in military mining.
5. Military map making. Each lieutenant of engineers, who has not already done so, and such noncommissioned officers and privates as may be selected from each company, will make satisfactory foot reconnaissances about 4 miles long, or a reconnaissance of position of equivalent area, in the vicinity of the post, the maps thereof to be submitted by company commanders to post headquarters on or before November 30, 1894.

II.—TORPEDO DRILLS.

6. After receiving such preliminary practice as may be necessary to acquaint them with the practical details of preparing and planting a torpedo, the officers of the torpedo class will be divided into details of at least two officers each, for the purpose of taking charge of the preparation and planting of a grand group of torpedoes, under the direction of the instructor in torpedoes, assisted by one engineer officer of the second or third winter's class.

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7. The senior officer will be in general charge, and will keep a daily journal of operations, noting particularly any difficulties encountered and any suggestions that may occur to him, looking to the avoidance of similar difficulties in the future.
8. The officers will frequently interchange duties so that each one shall have some experience in each part of the drill.
9. The electric light will be set up and operated.
10. The grand group being completed and the search light in position, the post commander will order an exhibition drill illustrating the operations of the torpedo defense against an attempted passage of the mine field by an enemy's vessel under cover of night.
11. The group will then be taken up by the same detail and the parts dismantled, cleaned, and conveniently grouped for the inspection of the instructor.
12. The detail will be instructed and exercised in automatic and judgment firing drills at such times as may be most convenient before the final exhibition drill.
13. The detail of enlisted men for each grand group drill will consist of three non-commissioned officers and about twelve privates.
14. The hours of work will be from 7 to 11.30 a. m., and from 1 to 4.30 p. m. In bad weather when no work is done and the men are in barracks, the latter will attend the same company duties and roll calls as daily duty men.
15. Weekly reports of progress will be rendered by the senior officer of the detail, and at the conclusion of the work each officer will submit a report of the work done by him, mentioning difficulties encountered and any suggestions he may desire to make.
16. A detailed record will be kept of what each man does with the view of tracing out the author of defective work and determining the degree of proficiency developed by individual members of the detail. An account of the character of work done by each man will be submitted by the senior officer with his final report.
17. Occasionally, if practicable, loaded mines will be planted and fired as in actual service, height of jet, effect on neighboring mines, and other phenomena being carefully observed and recorded.
18. At such times as will not interfere with the drills above mentioned, the officers of the class will make practical experiments in calibrating commercial ammeters and voltmeters, testing efficiency of dynamos and motors.

III.—Civil Engineering.

19. A topographical survey of about one-half square mile of ground by each officer of the first summer's class. Time allotted, five weeks.
20. A hydrographic survey of about one-fourth square mile by each officer of the second summer's class. Time allotted, four weeks.
21. While engaged in the fieldwork in topographical and hydrographic surveys the officers will be assisted by details of enlisted men, and will be excused from all other duties.

IV.—Field Astronomy.

22. All the lieutenants of engineers who have not already completed the course and been excused from further observations will constitute the observers.
23. Officers wishing to use the instruments for special observations or practice must apply for authority to do so and are not permitted to handle any instruments unless specifically assigned to them by the instructor.
24. In case of damage to instruments or apparatus, it will be promptly reported to the instructor for the action of a board of survey.
25. The following will be the ordinary routine of observations with the several instruments, after reasonable proficiency has been attained by preliminary practice:

SEXTANT.

After becoming skillful in the use of this instrument upon the sun, observers will deduce at least one satisfactory latitude by observing a north and a south star, using the time deduced from an east and a west star—each based on ten altitudes taken on the same night. These observations for latitude and time must be made at the observatory. The observer may get "time" from an assistant using a portable chronometer and will determine, by comparison, the error of standard chronometer at observatory.

CHRONOGRAPH.

Daily determination by time signal from Washington, D. C., of error and rate of astronomical clock, by the officer of the day.

TRANSIT.

A satisfactory set of time observations will be taken by each officer on two nights, successive if possible, determining satisfactorily the error of sidereal clock. The junior class will employ the eye and ear method; the senior class will use the chronograph.

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ZENITH TELESCOPE.

Observers will first determine the level correction by daylight, using a distant terrestrial object, or at night using a slow circumpolar star. They will then find the value of a turn of the micrometer by observing Polaris at elongation. Lastly they will observe for latitude, until they have obtained a satisfactory determination.

26. Suitable blank forms will be provided, both for observations and computations; and all problems must be submitted, complete in every detail, upon these forms. The original records after inspection by the commanding officer will be returned to the officers as their personal property.

27. Hours of attendance at the observatory will be regulated by the instructor.

V.—MILITARY PHOTOGRAPHY.

28. The course in military photography for lieutenants of engineers spending their first winter at the post will be five weeks. Practice will be had in the following methods: Negatives by dry process; developers and intensifiers; silver printing, and finishing and mounting of prints; map printing by the blue process and on bromide paper. Each officer to submit for examination two landscapes; negatives, silver and blue prints; two photographic copies; negatives, silver and blue prints; negative of map, with three blue and three bromide prints. Text-books: Griffin's Notes on Photography; Von Sothen's The Development of the Latent Image on Gelatino-Bromide of Silver; Reed, chapter on Photography applied to Topographical Sketching.

29. The building, apparatus, chemicals, etc., will be under the charge of the battalion quartermaster, whose duty it is to furnish any desired assistance, and who will be held responsible for the judicious use of the property.

30. Officers are invited to avail themselves of the advantages of the laboratory, making such arrangements with the officer in charge as shall insure no confusion in his official duties, or in those of the men under his instruction.

31. The instruction of enlisted men will be restricted to a weekly detail of one noncommissioned officer. Each noncommissioned officer taking the course will submit six specimens of his own work for examination.

32. The battalion quartermaster will submit to this office weekly reports showing the nature of the instruction given, the results attained, and the progress made.

By order of Lieutenant-Colonel King.

JAY J. MORROW,
Second Lieutenant of Engineers, Post Adjutant.

APPENDIX B.—PROGRAMME OF STUDY AND INSTRUCTION FOR WINTER SEASON.

[Printed Orders, No. 236.]

UNITED STATES ENGINEER SCHOOL,
Willets Point, New York Harbor, November 27, 1894.

The following programme of study and instructions for the ensuing winter season, commencing December 3, 1894, and ending May 31, 1895, having been recommeded by the academic staff and approved by the Chief of Engineers, will be carried into effect.

COURSE FOR OFFICERS.

1. Details of student officers for academic duty will be made weekly by the post adjutant. Officers will devote six hours daily to such duty, Saturdays and Sundays excepted, and excepting time consumed in sessions of general courts-martial. Each officer will record daily, in a book provided for that purpose, the disposition of his time for the previous day. Instructors will meet their classes at least weekly for assignment of lessons and examinations. As far as needful they will supplement the course with lectures. Examinations by the academic staff will be held about the end of February and of May. Marks at all examinations will be on the West Point system, and the results will be reported weekly to the commandant of the school.

FIRST WINTER'S COURSE.

2. The course for engineer officers spending their first winter at the school will be: Electricity and torpedoes, twenty-one weeks; surveying, three weeks. For officers of other arms of the service detailed for special instruction in the torpedo service: Electricity and torpedoes, twenty-four weeks.

ELECTRICITY.

3. Study of, in its application to torpedo warfare, arc and incandescent lighting, and transmission of power, supplemented by extensive laboratory practice in the solution of the special problems involved. Text-books and books of reference, as

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follows: Abbot's Notes on Electricity; Ayrton's Practical Electricity; Thompson's Electricity and Magnetism; Maier's Arc and Glow Lamps; Swinburn's Practical Electrical Measurements; Kapp's Electrical Transmission of Energy, Part II of Professional Papers No. 23, Corps of Engineers, U. S. Army; Gray's Absolute Measurements, Volume II; Monroe and Jamieson's Pocket Book of Electrical Rules and Tables; Thompson's Dynamo Electric Machinery.

TORPEDOES.

4. Text book: The Torpedo Manual. Practice will be had in making all the adjustments and tests required in planting and operating torpedoes, the operations on the water being simulated as far as practicable by special indoor appliances. Books of reference: Bucknill's Submarine Mines and Torpedoes as applied to Harbor Defense; Scheidnagel's Treatise upon Defensive Submarine Mining.

5. Attendance at the electrical laboratory will be regulated by the instructor. All laboratory work will be done without the use of text-books, or text-book diagrams. Officers may, however, use manuscript notes or diagrams previously prepared. Laboratory practice will be had from 9 a. m. to 12 m. and from 1 to 4 p. m. During the last two weeks of the course each engineer officer will prepare a plan (map and memoir) for the defense of such harbor as may be designated by the instructor, special attention being given to the torpedo defense and the batteries protecting the torpedo lines.

SURVEYING.

6. Subjects: (1) Adjustment, use, and care of instruments; (2) topographical surveying with transit and stadia; (3) hydrographic surveying and gauging of rivers; (4) geodetic surveying; (5) railway surveying. Text-books: Johnson's Theory and Practice of Surveying; Henck's Field Book for Engineers.

SECOND WINTER'S COURSE.

7. Civil engineering, ten weeks; military engineering, eight weeks; torpedoes, four weeks. The remaining two weeks to be devoted to the inspection of such civil and military engineering works as may be sanctioned by the commandant of the school.

CIVIL ENGINEERING.

8. Subjects: (1) Improvement of nontidal rivers; (2) improvement of tidal rivers; (3) canals; (4) building superintendence; (5) road making.

9. Text-books: Engineer School Notes; Selections from Harcourt's Rivers and Canals; Schlichting's Improvement of Nontidal Rivers; Annual Reports of the Chief of Engineers, U. S. A.; Catalogue of War Department Exhibit, World's Columbian Exposition, 1893, with models and photographs; Transactions American Society of Civil Engineers; Hodges's Mitering Lock Gates; Baker's Masonry Construction; Clark's Building Superintendence; Byrne's Highway Construction. Books of reference (see third winter's course).

MILITARY ENGINEERING.

10. Subjects: (1) Modern guns, carriages, and projectiles; (2) steel, compound, wrought and cast iron armor; (3) modern ships of war and seacoast defenses; (4) modern fortifications and their attack and defense.

11. Text-books: Such parts of the following books as may be designated by the academic staff: Woolwich Text-book of Fortifications; Maguire's Attack and Defense of Coast Fortifications; Fortifications of To-day; Armor, and its attack by Artillery, by Capt. Orde Browne; Proceedings of the International Congress of Engineers, Division of Military Engineering, Chicago, 1893; Baylay's Types of Modern Guns; Abbot's Lectures on Sea Coast Defense; Professional Papers No. X of U. S. Engineer School of Application.

12. Books of reference: Articles on Fortification and Gunnery, Encyclopœdia Britannica; Ordnance Notes No. 135 and Appendix; Volume 9, Professional Papers, Royal Engineers; Report of Board on Fortifications; McKinlay's Text-books on Gunnery; Brassey's Naval Annual; Annual Reports, Chief of Ordnance, U. S. A.; Artillery, Its Progress and Present Position, by Lloyd and Hadcock.

TORPEDOES.

13. Under the direction of the instructor in submarine mining, the instruction of enlisted men in the duties in the loading room and the boat service.

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THIRD WINTER'S COURSE.

14. Civil engineering, eleven weeks; military engineering, eight weeks; torpedoes, five weeks.

CIVIL ENGINEERING.

15. Subjects: (1) Wave and current action and improvement of harbors; (2) estimates; (3) road making; (4) mechanism; (5) steam engines and pumps; (6) office methods.

16. Text-books: Selections from Harcourt's Harbors and Docks; Annual Reports of Chief of Engineers, U. S. A.; Catalogue of War Department Exhibit, World's Columbian Exposition, 1893, with models and photographs; Transactions American Society Civil Engineers; Whitham's Constructive Steam Engineering; Schwamb's Elements of Mechanism; Byrne's Highway Construction.

17. Books of reference: Trautwine's Engineers' Pocketbook; Stevenson's Canal and River Engineering; Wheeler's Tidal Rivers; Billing's Ventilation and Heating; Reuleaux's Kinematics of Machinery; Allen's Practical Building Construction.

MILITARY ENGINEERING.

18. General Derrécagaix's Modern War, and preparation of project for the defense of such place as may be designed by the instructor.

TORPEDOES.

19. Under the direction of the instructor in submarine mining, the instruction of enlisted men in the duties in the loading room and the boat service.

COURSE FOR ENLISTED MEN.

INSTRUCTION OF ENLISTED MEN IN TORPEDOES.

20. Instruction will comprise telegraphing with the dial instrument, including the code for action, and practice in the Morse system of telegraphy; the duties of the loading room, and, so far as practicable, of the boat service as prescribed in the Torpedo Manual. They will also receive from the instructor in torpedoes, or his assistant, lectures respecting the fuses, explosives, torpedo material (except that of the operating room), voltaic batteries, simple electrical testing, and the use of the portable apparatus for the electrical ignition of mines.

The "unit" detail for this instruction will consist of one noncommissioned officer and four privates. Six such details will be kept under instruction. As soon as a man has had his work accepted, i. e., has received a rating of "2.5," he will be excused from further attendance, and in case he has shown a commendable amount of skill and intelligence in his duties, he will be a candidate for such special privileges as it may be deemed expedient to give him. A soldier qualifying twice as "2.5" will be excused from further detail during the winter season.

Recruits on their first detail will be kept under instruction indefinitely until they have done each task at least twice and have received a rating of at least "2.0." They will then be placed on the same footing as old soldiers for further details.

An officer from the second or third winter's class, detailed each week, will be in immediate charge, frequently inspecting the work of the several details. He will make it a special object to note the character of instruction given by the noncommissioned officers, who should know their duties well and who should be held to a strict account for any defective work that their details may do. He will rate the men as they complete their tasks by a detailed examination of their finished work and a more or less detailed course of questioning. In determining a man's "mark" regard will be had to the degree of intelligence displayed, as well as to the mechanical skill with which the work has been done. At the close of each week he will submit a "proficiency" report of the detail and state what verbal or other instruction was given during the week.

INSTRUCTION OF ENLISTED MEN IN PHOTOGRAPHY.

21. Two noncommissioned officers will be detailed each week for instruction in photography. Practice will be had in the following methods: Negatives by dry process; developers and intensifiers; silver printing, and finishing and mounting of prints; map printing by blue process and on bromide paper.

The following assignment of instructors is made:

Military engineering, Capt. William T. Rossell, Corps of Engineers.

Civil engineering, Capt. William M. Black, Corps of Engineers.

Submarine mining, Capt. W. L. Fisk, Corps of Engineers.

Military photography, Second Lieut. Edgar Jadwin, Corps of Engineers, Battalion Quartermaster.

By order Lieutenant-Colonel King:

JAY J. MORROW,
Second Lieutenant of Engineers, Post Adjutant.

APPENDIX C.—PROGRAMME OF STUDY AND INSTRUCTION FOR SUMMER SEASON.

[Printed Orders, No. 96.]

UNITED STATES ENGINEER SCHOOL,
Willets Point, New York Harbor, May 29, 1895.

The following programme of study and instruction for the ensuing summer season, to commence June 3 and end November 30, 1895, having been recommended by the academic staff and approved by the Chief of Engineers, will be carried into effect.

A roster of the student officers will be kept by the post adjutant, who will make weekly details for the various duties so that they shall not conflict.

I.—MILITARY ENGINEERING.

1. Practical instructions in the nomenclature, dimensions, and construction of modern field and siege batteries and saps. Also practical instructions in the location of works on irregular ground and the adaptation to site.
2. A full course of trestle and pontoon bridge drill.
3. Instruction in building spar bridges.
4. Instruction in military mining.
5. Military map making. Each lieutenant of engineers, who has not already done so, and such noncommissioned officers and privates as may be selected from each company, will make satisfactory foot reconnaissances about four miles long, or a reconnaissance of position of equivalent area, in the vicinity of the post; the maps thereof to be submitted by company commanders to post headquarters on or before November 30, 1895.

II.—TORPEDO DRILLS.

6. After receiving such preliminary practice as may be necessary to acquaint them with the practical details of preparing and planting a torpedo, the officers of the torpedo class will be divided into details of at least two officers each, for the purpose of taking charge of the preparation and planting of a grand group of torpedoes, under the direction of the instructor in torpedoes, assisted by one engineer officer of the second or third year's class.
7. The senior officer will be in general charge, and will keep a daily journal of operations, noting particularly any difficulties encountered and any suggestions that may occur to him, looking to the avoidance of similar difficulties in the future.
8. The officers will frequently interchange duties so that each one shall have some experience in each part of the drill.
9. The electric light will be set up and operated.
10. The grand group being completed and the search light in position, the post commander will order an exhibition drill illustrating the operations of the torpedo defense against an attempted passage of the mine field by an enemy's vessel under cover of night.
11. The group will then be taken up by the same detail and the parts dismantled, cleaned, and conveniently grouped for the inspection of the instructor.
12. The detail will be instructed and exercised in automatic and judgment firing drills at such times as may be most convenient before the final exhibition drill.
13. The detail of enlisted men for each grand group drill will consist of three noncommissioned officers and about twelve privates.
14. The hours of work will be from 7 to 11.30 a. m., and from 1 to 4.30 p. m. In bad weather, when no work is done and the men are in barracks, the latter will attend the same company duties and roll calls as daily duty men.
15. Weekly reports of progress will be rendered by the senior officer of the detail, and at the conclusion of the work each officer will submit a report of the work done by him, mentioning difficulties encountered and any suggestions he may desire to make.
16. A detailed record will be kept of what each man does, with the view of tracing out the author of defective work and determining the degree of proficiency developed by individual members of the detail. An account of the character of work done by each man will be submitted by the senior officer with his final report.
17. Occasionally, if practicable, loaded mines will be planted and fired as in actual service, height of jet, effect on neighboring mines, and other phenomena being carefully observed and recorded.
18. At such times as will not interfere with the drills above mentioned, the officers of the class will make practical experiments in calibrating commercial ammeters and voltmeters, testing efficiency of dynamos and motors.

III.—CIVIL ENGINEERING.

19. A topographical survey of about one-half square mile of ground by each officer of the first year's class. Time allotted, five weeks.

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20. A hydrographic survey of about one-quarter square mile by each officer of the second year's class. Time allotted, four weeks.

21. While engaged in the field work in topographical and hydrographic surveys the officers will be assisted by details of enlisted men, and will be excused from all other duties.

IV.—FIELD ASTRONOMY.

22. All the lieutenants of engineers who have not already completed the course, and been excused from further observations, will constitute the observers.

23. Officers wishing to use the instruments for special observations or practice, must apply for authority to do so, and are not permitted to handle any instruments unless specifically assigned to them by the instructor.

24. In case of damage to instruments or apparatus, it will be promptly reported to the instructor for the action of a board of survey.

25. The following will be the ordinary routine of observations with the several instruments, after reasonable proficiency has been attained by preliminary practice:

SEXTANT.

After becoming skillful in the use of this instrument upon the sun, observers will deduce at least one satisfactory latitude by observing a north and a south star, using the time deduced from an east and a west star—each based on ten altitudes taken on the same night. These observations for latitude and time must be made at the observatory. The observer may get "time" from an assistant using a portable chronometer, and will determine, by comparison, the error of standard chronometer at observatory.

CHRONOGRAPH.

Daily determination by time signal from Washington, D. C., of error and rate of astronomical clock, by the officer of the day.

TRANSIT.

A satisfactory set of time observations will be taken by each officer on two nights, successive, if possible, determining satisfactorily the error of sidereal clock. The junior class will employ the eye and ear method; the senior class will use the chronograph.

ZENITH TELESCOPE.

Observers will first determine the level correction by daylight, using a distant terrestrial object, or at night using a slow circumpolar star. They will then find the value of a turn of the micrometer by observing Polaris at elongation. Lastly, they will observe for latitude, until they have obtained a satisfactory determination.

26. Suitable blank forms will be provided, both for observations and computations, and all problems must be submitted, complete in every detail, upon these forms. The original records, after inspection by the commanding officer, will be returned to the officers as their personal property.

27. Hours of attendance at the observatory will be regulated by the instructor.

V.—MILITARY PHOTOGRAPHY.

28. The course in military photography for lieutenants of engineers spending their first winter at the post will be five weeks. Practice will be had in the following methods: Negatives by dry process; developers and intensifiers; silver printing, and finishing and mounting of prints; map printing by the blue process and on bromide paper. Each officer to submit for examination: Two landscapes; negatives, silver and blue prints, two photographic copies; negatives, silver and blue prints; negative of map, with three blue and three bromide prints. Text books: Griffin's Notes on Photography; Von Sothen's The Development of the Latent Image on Gelatino-Bromide of Silver; Reed, chapter on Photography applied to Topographical Sketching.

29. The building, apparatus, chemicals, etc., will be under the charge of the battalion quartermaster, whose duty it is to furnish any desired assistance, and who will be held responsible for the judicious use of the property.

30. Officers are invited to avail themselves of the advantages of the laboratory, making such arrangements with the officer in charge as shall insure no confusion in his official duties, or in those of the men under his instructions.

31. The instruction of enlisted men will be restricted to a weekly detail of one noncommissioned officer. Each noncommissioned officer taking the course will submit six specimens of his own work for examination.

32. The battalion quartermaster will submit to this office weekly reports showing the nature of the instruction given, the results attained and the progress made.

By order of Lieutenant-Colonel King:

JAY J. MORROW,
Second Lieutenant of Engineers, Post Adjutant.

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RIVERS AND HARBORS, ETC.

APPENDIX A.

IMPROVEMENT OF RIVERS AND HARBORS IN MAINE AND NEW HAMPSHIRE.

REPORT OF LIEUT. COL. D. P. HEAP, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1895, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. St. Croix River, Maine.
2. Lubec Channel, Maine.
3. Moosabec Bar, Maine.
4. Narraguagus River, Maine.
5. Breakwater from Mount Desert to Porcupine Island, Bar Harbor, Me.
6. Bagaduce River, Maine.
7. Penobscot River, Maine.
8. Belfast Harbor, Maine.
9. Camden Harbor, Maine.
10. Rockland Harbor, Maine.
11. Kennebec River, Maine.
12. Harraseeket River, Maine.
13. Portland Harbor, Maine.
14. Channel in Back Cove, Portland, Me.
15. Saco River, Maine.
16. Bellamy River, New Hampshire.
17. Cocheco River, New Hampshire.
18. Harbor of refuge at Little Harbor, New Hampshire.

EXAMINATIONS AND SURVEYS.

19. Glen Cove Harbor, Maine.
20. Royals River, Maine.
21. Parkers Head Harbor, Maine.
22. Cape Porpoise Harbor, Maine.
23. Machias River Channel, Maine.
24. Carvers Harbor, Maine.
25. Georges River, Maine.
26. Sasanoa River, Maine.

HARBOR LINES.

27. Rockland Harbor, Maine.

UNITED STATES ENGINEER OFFICE,
Portland, Me., July 3, 1895.

GENERAL: I have the honor to forward annual report for the fiscal year 1895 for river and harbor works in my charge.

Very respectfully, your obedient servant,

D. P. HEAP,
Lieut. Col., Corps of Engineers.

Brig. Gen. WM. P. CRAIGHILL,
Chief of Engineers, U. S. A.

A 1.

IMPROVEMENT OF ST. CROIX RIVER, MAINE.

An examination of the river was made in 1867 by the officer in charge of the district, and subsequently appropriations amounting to $35,000 in the aggregate were made for the improvement, but the

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appropriation of 1867 provided that the Dominion Government of Canada should expend an equal amount on the improvement. In 1873 the Dominion Government of Canada appropriated $25,000 for improving the river, that being the amount that had been appropriated up to that time by the United States. A conference was held by the engineer of the district with an agent of the Dominion Government, and a plan of improvement was agreed upon. The obstructions consisted of slabs, sawdust, and other mill waste; but before allowing the expenditure of the money appropriated by the Government of Canada the minister of public works required that some guaranty should be given that the further deposit of this refuse in the river should be discontinued. As there did not seem to be any law at that time by which the deposit could be prevented, the money that had been appropriated was not expended on that improvement (with the exception of $1,000 for a survey of the river from the "ledge" to the head of navigation made in 1873), and in 1879 Congress authorized the appropriations made for the St. Croix to be expended on Lubec Channel, which was done.

The appropriation of 1881 was for "repairing breakwater on the St. Croix River near Calais," and was expended for that purpose.

The following appropriations have been made:

Act of—	
March 2, 1867	$15,000
March 3, 1873	10,000
June 23, 1874	10,000
March 3, 1881	4,000
September 19, 1890	35,000
Total	74,000

The river and harbor act of August 11, 1888, provided for an examination and survey of the St. Croix River, the reports on which were published in Annual Report of the Chief of Engineers for 1890 (p. 463).

When the survey was made the available depth over the shoals at mean low tide was from 6.5 to 9.5 feet, and at the upper steamboat wharf at Calais it was but 1.5 feet. The channel was also narrow.

The improvement proposed was a channel 12 feet deep at mean low tide and generally 200 feet wide (but narrowed to 150 and 100 feet in the upper part of the harbor to avoid ledge) up to the upper steamboat wharf, immediately below the bridge, which marks the head of navigation. Such improvement would enable steamboats to land at the upper wharf at all stages of the tide, and would also permit the larger vessels engaged in the lumber trade to receive their full cargoes at the wharves, instead of dropping down the river nearly 4 miles after being partially loaded and completing their cargoes from material rafted down to them. The object was to be accomplished by dredging and by the construction of a small jetty and training wall. The work proposed extends over about 4 miles of the river. The difference between high and low tides is about 20 feet. The estimated cost of the improvement was $280,000.

The act approved September 19, 1890, appropriated $35,000 for the improvement of the St. Croix, "but upon condition that the Government of the Dominion of Canada shall expend a like sum in the improvement of said river." On account of the proviso contained in the act no expenditures were made and no work was done under the appropriation of September 19, 1890, pending action by the Dominion Government, and by a provision in the river and harbor act of August 17, 1894, the Secretary of War was authorized, in his discretion, to expend the appropriation on the work of improving Lubec Channel, Maine.

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Money statement.

July 1, 1894, balance unexpended	$35,000.00
August 17, 1894, balance authorized to be expended for improving Lubec Channel	35,000.00
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	280,000.00

COMMERCIAL STATISTICS.

Articles.	1891.	1892.	1893.	1894.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Bricks	500	1,000	500	300
Cement	1,000	800	700	800
Coal	30,000	35,000	40,000	50,000
Cotton	5,730	6,000	6,000	4,000
Farm produce	10,000	10,000	8,000	10,000
Grain	10,000	12,000	10,000	8,000
Flour	8,000	8,000	10,000	10,000
Iron	1,000	1,500	2,000	1,500
Lime	5,000	4,000	3,000	4,000
Lumber	190,000	180,000	170,000	150,000
Plaster	15,000	16,000	15,000	18,000
Plaster rock	17,000	17,000	20,000	20,000
Granite			2,000	10,000
Miscellaneous	100,000	100,000	75,000	75,000
Total	393,230	391,300	362,200	361,600

Number of vessels arriving and departing during calendar year 1894.

Vessels 150 tons and upward	700
Sloops and lighters under 150 tons	700
Steamers and foreign cargoes	800

A 2.

IMPROVEMENT OF LUBEC CHANNEL, MAINE.

This channel lies between the eastern extremity of the State of Maine and Campobello Island, Dominion of Canada. It has a length of between 2 and 3 miles, connecting the waters of Quoddy Roads below with those of Friar Roads above. The least width between low-water contours is about 400 feet, and between high-water contours about 800 feet. The mean range of tides is about 17 feet. It affords a sheltered route, and the most direct one, for vessels to and from Eastport and the St. Croix River, besides being the only passage not in waters belonging to the Province of New Brunswick. The channel is also important in connection with Quoddy Roads as a harbor of refuge. During such storms as make anchorage in the latter unsafe, vessels may escape through the Lubec Channel into sheltered waters above.

The following appropriations have been made:

Act of—	
March 3, 1879	$44,000
June 14, 1880	20,000
March 3, 1881	45,000
August 2, 1882	20,000
July 5, 1884	10,000
August 5, 1886	10,000
August 11, 1888	20,000
August 17, 1894	5,000
August 17, 1894, unexpended balance for improving St. Croix River, made available for Lubec Channel	35,000
Total	209,000

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Previous to 1879 the mean low-water depth in the channel did not exceed 5 feet, and at extreme low water the depth did not exceed 2 feet.

The project adopted in 1879 provided for a channel 200 feet wide and 12 feet deep at mean low tide, which would be equivalent to 9 feet at low spring tides. The estimated cost was $48,000.

This estimate was based on prices below what the work was subsequently done for. This project was revised in 1880, the estimated cost being increased to $130,000. The project was again, in 1884, amended so as to provide a channel 275 feet wide and 300 feet wide in the bends, the depth of 12 feet being retained, and the estimated cost of the entire project being increased to $171,500.

At the close of the fiscal year ending June 30, 1894, there had been expended the sum of $168,954.68. The project of 1879 was completed.

The river and harbor act approved September 19, 1890, contained an order for an examination of Lubec Channel, the report on which was published in the Annual Report of the Chief of Engineers for 1891 (p. 616). A new project was therein submitted for a channel having a least width of 500 feet and a depth of 12 feet at mean low water.

This project was adopted by the act of August 17, 1894, by which $5,000 was appropriated, and an unexpended balance of $35,000 appropriated for improving St. Croix River was made available for Lubec Channel.

The estimated cost of the work to complete the new project is $150,000.

No work was done during the year ending June 30, 1895. The expenditures during the year were $44.91, making the total expenditures $168,999.59.

March 5, 1895, a contract was made with Moore & Wright, of Portland, Me., for dredging about 120,000 cubic yards in widening the channel at the entrance and at and near the turn just above Cranberry Point. The price is 31 cents per cubic yard. The work will be commenced during the present working season and will be the first under the new project.

There is a light-house about one mile to the southward of Lubec, on the westerly edge of the dredged channel. Lubec Narrows is in the collection district of Passamaquoddy.

Money statement.

July 1, 1894, balance unexpended		$45.32
Amount appropriated by act of August 17, 1894		*40,000.00
		40,045.32
June 30, 1895, amount expended during fiscal year		44.91
July 1, 1895, balance unexpended		40,000.41
July 1, 1895, outstanding liabilities	$25.00	
July 1, 1895, amount covered by uncompleted contracts	37,200.00	
		37,225.00
July 1, 1895, balance available		2,775.41

Amount (estimated) required for completion of existing project	110,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

*Includes $35,000 transferred from St. Croix River.

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Abstract of proposals for dredging in Lubec Channel, Maine, February 18, 1895.

No.	Name and address of bidder.	200,000 cubic yards.	
		Price per cubic yard.	Amount.
		Cents.	
1	Moore & Wright, Portland, Me.	31	$62,000
2	Charles H Souther, Boston, Mass.	46	92,000

Contract made with Moore & Wright March 5, 1895.

COMMERCIAL STATISTICS.

The commerce of Lubec Channel not being local in its character, it is impracticable to obtain definite statements of the tonnage. The deputy collector of customs at Lubec has reported that the total number of vessels, steam and sail, passing through Lubec Channel during the calendar year 1894 was 3,367, having an estimated tonnage of 640,000 tons.

A 3.

IMPROVEMENT OF MOOSABEC BAR, MAINE.

Moosabec Bar is in the eastern part of Moosabec Reach, near Jonesport, Me. At mean low stages the depth was less than 6 feet and at extreme low tides the depth was less than 4 feet. In fogs, which are prevalent on this part of the coast, navigation was rendered dangerous by the tortuous route that had to be taken to keep clear of the ledges.

A survey, ordered in the river and harbor act of March 3, 1879, was made by Col. George Thom and a project of improvement suggested, the estimated cost of which was $28,000. The project contemplated the excavation of a straight channel, running nearly east and west, 200 feet wide and 14 feet deep at mean low tide, and the removal of a sunken ledge near Steamboat Buoy to 15 feet. The project was adopted in 1881, but the estimated cost was increased to $35,000. In 1882 the project was amended, as it was found that the quantity of dredging had to be increased, so that the cost as revised was estimated at $40,000. Work on that project was continued until 1888, when it was amended so as to provide for a channel 300 feet wide and 14 feet deep, the removal of certain ledges near the westerly end of the dredged channel to a depth of 16 feet, and the construction of a small breakwater to check cross currents. The estimated cost of the additional work was $110,000, and that for the entire improvement as enlarged, $150,000. This latter project is the one now in process of execution.

The following appropriations have been made:

Act of—		Act of—	
March 3, 1881	$10,000	September 19, 1890	$15,000
August 2, 1882	10,000	July 13, 1892	15,000
July 5, 1884	10,000	August 17, 1894	6,000
August 5, 1886	10,000		
August 11, 1888	15,000	Total	91,000

The expenditures to June 30, 1894, were $75,432.01.

At the latter date the 300-foot channel had been completed to the full projected width and depth, the breakwater had been built, and 1,047 cubic yards of ledge had been removed from the western approach to the dredged channel.

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The expenditures during the past year amounted to $6,913.34.

The operations have consisted in continuing the work of removing ledge in the western approach to the dredged channel. A contract made in March, 1894, covering the removal of about 700 cubic yards of ledge is about completed, and work under another contract made in March, 1895, covering about 400 cubic yards, will be in progress during the present season. With the completion of these contracts, a depth of 16 feet at mean low tide will be had at the western approach for a width of from 300 to 400 feet.

The improvement is in the collection district of Machias, Me., which is the nearest port of entry. The nearest light-house is Moose Peak.

Money statement.

July 1, 1894, balance unexpended		$9,567.99
Amount appropriated by act of August 17, 1894		6,000.00
		15,567.99
June 30, 1895, amount expended during fiscal year		6,913.34
July 1, 1895, balance unexpended		8,654.65
July 1, 1895, outstanding liabilities	$825.76	
July 1, 1895, amount covered by uncompleted contracts	7,367.50	
		8,193.26
July 1, 1895, balance available		461.39
Amount (estimated) required for completion of existing project		59,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		25,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for removal of ledge in western approach to channel through Moosabec Bar, Maine, February 18, 1895.

No.	Name and address of bidder.	900 cubic yards ledge.	
		Price per cubic yard in place.	Amount.
1	Townsend & Johnston, Somers Point, N. J.	$13.20	$11,880
2	Andrew W. Bryne, West Medford, Mass.	14.00	12,600

Contract made with Townsend & Johnston, March 9, 1895.

Abstract of contracts for improving Moosabec Bar, Maine, in force during the fiscal year ending June 30, 1895.

No.	Name and address of contractor.	Date of contract.	Subject of contract.	Price per cubic yard in place.
1	Townsend & Johnston, Somers Point, N.J.	Mar. 22, 1894	Removal of ledge in western approach to channel.	$13.25
2	.....do	Mar. 9, 1895	.....do	13.20

COMMERCIAL STATISTICS.

The benefits derived from the improvement are not local, the thoroughfare being used by coastwise vessels both as a harbor of refuge and as a sheltered route in bad weather. It is therefore impracticable to obtain accurate commercial statistics. The number of vessels passing through the reach annually has been estimated to be as great as 2,500.

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A 4.

IMPROVEMENT OF NARRAGUAGUS RIVER, MAINE.

The part of the river to which the project of improvement applies is that near the mouth and at the head of the Narraguagus Bay, below the village of Millbridge. The river is navigable for small vessels as far up as Cherryfield, 5 miles above Millbridge.

Before the improvement was commenced the depth over the bar at the mouth of the river was less than 6 feet at mean low tide and less than 4 feet at extreme low tide.

From Millbridge to Cherryfield, the head of navigation, a distance of about 5 miles, the navigation was obstructed by bowlders and ledges.

The following appropriations have been made:

For improvement above Millbridge:	
Act of March 3, 1871	$12,000
Act of June 10, 1872	10,000
For improvement below Millbridge:	
Act of August 5, 1886	10,000
Act of August 11, 1888	10,000
Act of September 19, 1890	7,500
Act of July 13, 1892	7,500
Act of August 17, 1894	5,000
Total	62,000

The original project provided only for the betterment of navigation above Millbridge by the removal of obstructions, such as mill-waste, sunken bowlders, and projecting ledges, and the construction of an iron spindle on Half Tide Rock. This work was completed in 1874, the amount expended being $22,000 (the first two appropriations). The resulting improvement is said to have been of great benefit to navigation.

A second project for the improvement of the river below Millbridge was submitted in 1880, but no appropriation was made until 1886.

The project for the improvement of this part of the river has for its object the dredging of a channel not less than 200 feet wide from deep water in Narraguagus Bay to the place known as "Deep Hole," where vessels anchor in bad weather, the depth to be 11 feet at mean low water as far up as Long Point, and from thence to "Deep Hole" to be 9 feet.

The mean range of the tides is 11.2 feet.

The estimated cost of this improvement was $50,000.

The expenditures under the last project, up to June 30, 1894, amounted to $27,559.40. At that date there had been dredged an 11-foot channel from the deep water in the bay toward the new steamboat wharf, 90 feet wide, with a space in front of the wharf 300 feet wide. From the new steamboat wharf to the old one near Long Point the channel was 100 feet wide, with a turning basin in front of the old wharf 300 feet wide.

The expenditures during the fiscal year ending June 30, 1895, amounted to $26.18. No work was in progress during the year.

A contract was made in March, 1895, with Columbia Dredging Company for dredging about 90,000 cubic yards, in widening and extending the channel. The work is to be done during the present season.

The improvement is in the collection district of Machias. The nearest port of entry is Machias. The nearest light-house is Narraguagus Light-House, on Pond Island.

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Money statement.

July 1, 1894, balance unexpended	$7,440.60
Amount appropriated by act of August 17, 1894	5,000.00
	12,440.60
June 30, 1895, amount expended during fiscal year	26.18
July 1, 1895, balance unexpended	12,414.42
July 1, 1895, amount covered by uncompleted contracts	11,430.00
July 1, 1895, balance available	984.42
Amount (estimated) required for completion of existing project	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

Abstract of proposals for dredging in Narraguagus River, Maine, February 18, 1895.

No.	Name and address of bidder.	100,000 cubic yards.	
		Price per cubic yard in scow.	Amount.
		Cents.	
1	Moore & Wright, Portland, Me.	13¼	$13,250
2	Columbia Dredging Co., Fall River, Mass.	12 7/10	12,700

Contract made with Columbia Dredging Company March 4, 1895.

COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	1891.	1892.	1893.	1894.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Coal	1,200	2,000	1,500	1,000
Fish and salt	1,582	.....	400	1,500
Hides and leather	675	.....	800	1,400
Hay	.....	300	75	100
Hardware and iron	200	1,500	2,000	2,400
Lumber	38,077	30,000	50,000	85,000
Miscellaneous	4,725	7,000	2,600	1,700
Stone and silica	2,500	4,500	3,500	2,500
Total	48,959	45,300	60,875	95,600

There arrived during the calendar year 1894: Steamers, coastwise, average draft 7 feet; tonnage, 135,000. Sailing vessels, coastwise, average draft 8 feet; tonnage, 25,000. Vessels for refuge only, tonnage, 12,000.

A 5.

BREAKWATER FROM MOUNT DESERT TO PORCUPINE ISLAND, BAR HARBOR, MAINE.

The anchorage in front of the town of Bar Harbor, Mount Desert Island, Maine, as well as the wharves at which steamers make their landings, is exposed to the seas from southerly and southeasterly directions. In southerly gales the anchorage is insecure, and the landing of passengers and freight at the wharves is difficult at such times. The number of people that visit Bar Harbor in the summer is large, but the amount of freight delivered and shipped is comparatively small. The

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anchorage is used chiefly by yachts. There are neither factories nor quarries on this part of the island, and the trade is chiefly in supplies of all kinds for summer visitors.

The original project was the construction of a riprap breakwater from the westerly side of Round Porcupine Island to Dry Ledge and thence in a direct line to a point near the shore of Mount Desert Island. In December, 1890, it was proposed to slightly change the direction of the part of the breakwater west of Dry Ledge so that the westerly end would be somewhat farther to the southward.

In January, 1893, the project was again amended and now provides for the construction of a breakwater on the direct line first proposed, but somewhat shorter, terminating at a distance of about 600 feet from the low-water line on Mount Desert Island, the structure to be built to the level of mean high tide with slopes of 1 on 1 and a width of 20 feet on top throughout its entire length. This construction will, it is believed, answer all needful requirements at this locality and at a total cost not much more than one-half that of the project of 1890.

The estimated cost of the project as it now stands is $420,200.

The following appropriations have been made:

Act of—		Act of—	
August 11, 1888	$50,000	July 13, 1892	$50,000
September 19, 1890	50,000	August 17, 1894	10,000

The expenditures to June 30, 1894, amounted to $101,070.52. Up to the latter date the entire quantity of stone placed in the work amounted to 114,325 tons. That part of the breakwater between Porcupine Island and Dry Ledge was completed, and about 400 feet of the breakwater west of Dry Ledge had been completed to full section.

The expenditures during the past fiscal year were $48,678.12, making the total expenditures $149,748.64.

At the close of the fiscal year 1894 work was in progress, under contract, on that part of the breakwater west of Dry Ledge. The contract was completed about the middle of September, 1894; 46,555 tons of stone were delivered under this contract, completing the breakwater to a point 535 feet westward from Dry Ledge.

In March, 1895, a contract was made with Hamilton & Cleaves for continuing the work. The appropriation of 1894 being small in amount the work under this contract will not be great—about 15,000 tons. The work is now in progress and the contract is due to be completed during the present season.

Bar Harbor is in the collection district of Frenchman Bay. The nearest port of entry is Ellsworth. The nearest light-house is on Egg Rock, 3½ miles distant.

Money statement.

July 1, 1894, balance unexpended		$48,929.48
Amount appropriated by act of August 17, 1894		10,000.00
		58,929.48
June 30, 1895, amount expended during fiscal year		48,678.12
July 1, 1895, balance unexpended		10,251.36
July 1, 1895, outstanding liabilities	$466.55	
July 1, 1895, amount covered by uncompleted contracts	8,804.52	
		9,271.07
July 1, 1895, balance available		980.29

Amount (estimated) required for completion of existing project..... 260,200.00
Amount that can be profitably expended in fiscal year ending June 30, 1897 50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

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Abstract of proposals for construction of breakwater from Mount Desert to Porcupine Island, Maine, February 18, 1895.

No.	Name and address of bidder.	From Porcupine Ledge in a westerly direction (10,000 tons of stone).	
		Price per ton.	Amount.
		Cents.	
1	Philip H. Doyen, Knightville, Me	88	$8,800
2	Joseph F. Curit, Chebeague, Me	78	7,800
3	George Willett Andrews, Biddeford, Me	97	9,700
4	Hamilton & Cleaves, Portland, Me	74	7,400

Contract made with Hamilton & Cleaves March 1, 1895.

Abstract of contracts for construction of breakwater from Mount Desert to Porcupine Island, Maine, in force during fiscal year ending June 30, 1895.

No.	Name and address of contractor.	Date of contract.	Subject of contract.	Price for stone per ton.
				Cents.
*1	William S. White, Rockland, Me	Nov. 22, 1893	Breakwater west of Porcupine Ledge	97
2	Hamilton & Cleaves, Portland, Me.	Mar. 1, 1895	.....do	74

* Contract completed.

COMMERCIAL STATISTICS.

No statement of tonnage could be obtained, but there has been no great change in the conditions.

The traffic is chiefly the transportation of passengers and supplies.

A 6.

IMPROVEMENT OF BAGADUCE RIVER, MAINE.

The Bagaduce is a small stream that empties into Penobscot Bay at Castine, Me. The upper part of the river divides into two branches, one called Northern Bay and the other South Bay.

Northern Bay, near South Penobscot, is a shoal sheet of water of about 700 acres area, the bottom of which for the greater part is bare at low tide. There is a narrow channel from Bridges Point to Bowdens Wharf, which had a depth of less than 2 feet and is obstructed by ledges near Winslows Island. The South Bay is obstructed by ledges at Johnsons Narrows.

A project for the improvement of the Northern Bay was adopted in 1890, which has for its object the securing of a channel 100 feet wide and 6 feet deep at mean low tide from Bridges Point to Bowdens Wharf, at an estimated cost of $45,000.

It is also intended to remove a small quantity of rock obstructing the South Bay at Johnsons Narrows, at an estimated cost of $1,875.

The mean range of tide is about 9.5 feet.

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The following appropriations have been made:

Act of—	
August 11, 1888	$3,000
September 19, 1890	4,000
July 13, 1892	5.000
August 17, 1894	5,000

The expenditures to the close of the fiscal year ending June 30, 1894, amounted to $12,000. As a result the channel had been dredged its entire length for a width of 40 feet, but the full projected depth had not been obtained throughout. There was an available depth of about 2 feet more than before the improvement was commenced.

The expenditures during the year ending June 30, 1895, were $4,795.09, making the total expenditures $16,795.09.

A contract was made March 13, 1895, with Columbian Dredging Company, of East Boston, Mass., for deepening the channel where it was shoalest by removing bowlders at Winslows Island about midway of the length of the channel. Work was commenced about the middle of April, 1895, and was in progress until May 29, 1895, when the contract was completed.

About 1,150 tons of bowlders were removed, increasing the available depth at that locality to about 2 feet at mean low tide. The price was $4 per ton of 2,000 pounds.

The improvement is in the collection district of Castine. The nearest port of entry is Castine, at the mouth of the river. The nearest light-house is at Dice Head.

Money statement.

Amount appropriated by act of August 17, 1894	$5,000.00
June 30, 1895, amount expended during fiscal year	4,795.09
July 1, 1895, balance unexpended	204.91
July 1, 1895, outstanding liabilities	200.00
July 1, 1895, balance available	4.91
Amount (estimated) required for completion of existing project	29,875.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	29,875.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for removing bowlders in Bagaduce River, Maine, February 18, 1895.

No.	Name and address of bidder.	2,000 tons of bowlders.	
		Price per ton.	Amount.
1	Columbian Dredging Co, East Boston, Mass	$4.00	$8,000
2	George Willett Andrews, Biddeford, Me	3.73	7,460
3	Joseph F. Curit, Chebeague, Me	11.00	22,000
4	Philip H. Doyen, Knightville, Me	3.85	7,700
5	John F. Hamilton and Aaron Cleaves, Portland, Me	10.00	20,000
6	Townsend & Johnston, Somers Point, N. J	4.75	9,500

Contract made with Columbian Dredging Company, March 13, 1895.

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COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	1891.	1892.	1893.	1894.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Bricks	6,000	7,500	8,000	8,000
Coal	2,200	2,350	2,300	2,500
Cotton	150	150	200	200
Farm produce	250	300	400	400
Fish	150	300	250	300
Grain	8,000	9,000	9,000	9,500
General merchandise	15,300	17,000	18,000	20,000
Granite				5,000
Ice	150	200	250	350
Iron pipe (water)				100
Lumber	2,800	3,500	5,000	15,000
Lime, cement, etc	300	400	400	1,000
Wood	6,000	5,400	5,500	5,500
Total	41,300	46,100	49,300	67,850

Most of the above is landed and shipped from Castine, at the mouth of the river.

Arrivals in 1894: In summer months, 7 steamers daily; in winter months, 2 steamers daily; no estimate of sailing vessels, but vary in draft from 6 to 15 feet.

A 7.

IMPROVEMENT OF PENOBSCOT RIVER, MAINE.

A survey of the Penobscot River was made in 1867 under the provisions of the act of Congress approved June 23, 1866. The navigation at that time was obstructed by rocks, ledges, and mill waste, giving at mean low tide only about 8 feet of water, and a narrow, tortuous, and uncertain channel. At Bangor the depth was only about 6 feet at lowest stages, while numerous rocks and ledges made navigation dangerous. Colonel Thom, under whose direction the survey was made, submitted an estimate for two projects of improvement, one giving a channel 150 feet wide and 12 feet deep at extreme low tide, up as far as Bangor, at an estimated cost of $125,000, and another with a depth of 18 feet at extreme low tide, at an estimated cost of $665,000.

The improvement of navigation was not undertaken, however, until 1870, when the first appropriation was made. Work on the 12-foot project was then systematically undertaken, and was continued until 1880, under the several appropriations made by Congress. The original project was amended several times during this period. This was rendered necessary by the discovery of shoals where before they were not known to exist, and by work being ordered by Congress which was not included in the original estimates. In 1876 the project was amended so as to provide for a depth of 11 feet at extreme low tide, and as thus amended it was completed in 1880. The expenditures up to that time amounted to $198,000, and had resulted in straightening, deepening, and widening the channel through the several shoals and bars at Bangor and for a distance of about 3½ miles downstream, giving it a width of 200 feet and a depth of not less than 11 feet at extreme low tide, or 14 feet at mean low stages; also in breaking up and removing all the sunken ledges and bowlders in the harbor of Bangor, some outside the main channel, down to the level of the general bed of the river, including Independence Rock, Gullivers Rock, ledge near the steamboat

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wharf, and ledges near Dole's Wharf, Green's Pier Ledge, and a ledge outside of it, the ledges and bowlders in front of the wharves at High Head, and also the removal of the shoal at Bucksport, known as the Middle Ground, on which there had formerly been only 4 feet of water at mean low tide.

No further work was done on the Penobscot River until 1883, when a new survey was made by Colonel Blunt, under the provisions of the river and harbor act of 1882. He reported that the improvements made were satisfactory as far as they went, but the increasing commerce of Bangor demanded additional facilities. He submitted a project for widening the channel at Bangor 100 feet, making it 300 fect wide, and for widening, straightening, and deepening the river near Crosbys Narrows, at an estimated cost of $75,000. A project for this improvement was adopted in 1884 and work on it begun. While it was in progress the river and harbor act of 1886 called for another survey of the Penobscot River from Bangor to Bucksport Narrows. This survey was made in 1887, under the direction of Lieut. Col. Jared A. Smith, who submitted a project January 11, 1888, for improving the river from Winterport to Bucksport, at an estimated cost of $365,000. The project contemplated the securing of 22 feet at mean low tide between Bucksport and Winterport, by means of contraction works aided by dredging. The estimated cost of the two projects combined was thus made $440,000, of which $85,000 had already (in 1888) been appropriated. The act of September 19, 1890, appropriated $25,000 and provided for dredging near Sterns Mill. This was no part of any of the projects submitted, but was ordered by Congress.

In the river and harbor act of September 19, 1890, Congress directed still another survey to be made of the Penobscot River, Maine. This was done by Lieut. Col. Jared A. Smith, Corps of Engineers, and a report was submitted which was published as House Ex. Doc. No. 37, Fifty-second Congress, first session. The works of improvement suggested in this report are to still further widen the channel at Bangor on the Brewer side 60 feet, making it 360 feet wide, keeping the same depth as before; to deepen the river between Winterport and Bucksport, by the construction of jetties, to 22 feet at mean low tide, and near Crosbys Narrows to 12 feet by the same means. The estimated cost of this last project is $202,000.

The general project under which the improvement of the Penobscot River is now being carried on may be stated as follows:

To widen the channel at Bangor to 360 feet and a depth of 11 feet at extreme low tide; to widen, straighten, and deepen the channel near Crosbys Narrows and near Sterns Mill to a depth of 12 feet at extreme low tide, and to secure a channel depth of 22 feet at mean low tide between Bucksport and Winterport, the estimated cost of the entire work being $440,000, of which $150,000 has been already appropriated.

This estimate includes the cost of jetties at Frankfort Flats and High Head to contract the waterway, should contraction be necessary. It is thought, however, that as the deposit of sawdust and mill waste into the river has in a large measure been stopped, and as the channels at these places were obstructed chiefly by this material the contraction works may not be necessary. The channel at Frankfort Flats was dredged in 1890 to 22 feet. Subsequently it filled up on the sides to some extent, the full depth in mid-channel being maintained. A recent survey showed that it had scoured out again and there existed a navigable channel not less than 500 feet wide and 22 feet or more in depth at low tide. As this is all the project aims at, no further works of any kind are needed at Frankfort Flats.

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The channel at High Head, which had deepened in 1891 from natural causes, subsequently filled up to some extent, so that it became advisable to dredge a channel the full depth and width called for by the project. This was done, under contract, during the season of 1894, and it is thought that the channel may maintain its depth and render further work unnecessary.

The construction of jetties at Frankfort Flats and High Head should be avoided, if practicable, on account of their great cost.

Under the circumstances no appropriation is asked for the Penobscot River.

The following appropriations have been made for the Penobscot River:

March 2, 1829 (for survey)	$300
July 11, 1870 (at Bangor and below)	15,000
March 3, 1871 (at Bangor and below)	50,000
June 10, 1872	40,000
March 3, 1873	20,000
June 23, 1874	20,000
March 3, 1875 ($10,000 to be expended at or near Bucksport Narrows)	25,000
August 14, 1876 ($4,000 to be expended at or near Bucksport Narrows)	10,000
June 18, 1878 ($2,500, or so much thereof as necessary, to be expended at or near Bucksport Narrows)	12,000
March 3, 1879	6,000
July 5, 1884 (for Bangor Harbor and Penobscot River)	20,000
August 5, 1886 (for widening channel at Bangor and removing obstructions near Crosbys Narrows)	15,000
August 11, 1888 ($20,000 to be expended between Bangor and Crosbys Narrows and $30,000 between Bucksport and Winterport)	50,000
September 19, 1890 (for continuing improvement and for dredging near Sterns Mill)	25,000
July 13, 1892	40,000
Total	348,300

The expenditures under the various projects up to the close of the fiscal year ending June 30, 1894, amounted to $319,264.77.

The results accomplished were the widening and deepening of the channel at Bangor from a depth of 6 feet at extreme low tide to 11 feet, for a width of 360 feet; the dredging of the shoal at Sterns Mill to 12 feet and of the shoal just below Sterns Mill to the same depth; the removal of rocks, ledges, and other obstructions; the dredging of the shoal near Bucksport, and a general increase in depth and width of channels from the mouth up to Bangor.

The expenditures during the last fiscal year were $18,496.80, making the total expenditures for the work $337,761.57.

At the close of the last annual report work was in progress under a contract for dredging a channel at High Head, just above Bucksport, and for redredging at Bangor, where some shoaling had taken place. The contract was completed early in November, 1894, by which time 69,335 cubic yards had been dredged at High Head and 17,179 cubic yards at Bangor, making the depth 22 feet at mean low tide at the former place and 12 feet at extreme low tide at the latter.

Bangor, at the head of navigation, is a port of entry.

Money statement.

July 1, 1894, balance unexpended	$29,035.23
June 30, 1895, amount expended during fiscal year	18,496.80
July 1, 1895, balance unexpended	10,538.43
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	290,000.00

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COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	1891.	1892.	1893.	1894.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Ashes	500	500	575	438
Bricks	8,575	3,266	2,840	1,940
Brimstone	.....	500	535	2,173
Coal	104,113	115,000	120,000	120,091
Farm produce	2,025	2,000	2,300	2,162
Fish and oysters	107	200	240	200
Flour and grain	11,865	6,325	6,840	13,646
Fertilizer and plaster rock	1,400	2,000	2,140	4,750
General merchandise	51,333	52,209	53,420	51,820
Hay and wood	72,220	12,647	13,000	10,200
Iron, castings, etc	505	840	12,600	1,210
Ice	270,000	181,000	90,000	193,789
Lime and cement	568	4,350	4,400	2,615
Lumber	320,000	294,603	223,332	315,200
Last blocks	.....	400	400	325
Molding sand and potter's clay	.....	1,000	1,200	820
Miscellaneous	53,728	.....	700	1,154
Molasses and salt	1,841	2,701	1,771	1,945
Oil	2,500	3,094	3,594	5,070
Paving stone, granite, and slate	30,500	32,300	26,000	20,765
Total	931,780	714,935	565,887	750,313

Number of vessels arriving in calendar year 1894.

Vessels.	Number.	Tonnage.
Steamers, coastwise:		
Drawing 10 feet or more	218	295,258
Drawing less than 10 feet	430	117,917
Sailing vessels:		
Foreign, drawing 10 feet or more	8	1,901
Coastwise, drawing 10 feet or more	921	205,944
Coastwise, drawing less than 10 feet	614	117,295
Barges, drawing 10 feet or more	30	9,000

A 8.

IMPROVEMENT OF BELFAST HARBOR, MAINE.

Before the improvement was begun the harbor was not deep enough to accommodate the steamers and other vessels that visited the port.

Near Lane's Wharf there was a shoal on which the depth was only about 4 feet at mean low tide, but it deepened toward the mouth of the harbor.

A survey was made of the harbor in 1875 and a report submitted. As a result of the survey it was ascertained that to so improve the harbor as to afford a safe anchorage for shipping in all storms, and have a suitable depth for the several steamers and other vessels that touch and lie there in all stages of the tide, would require the removal of certain shoals and the construction of a breakwater or breakwaters at the entrance to the harbor. The estimated cost was $347,000. The dredging alone was estimated to cost $35,000. The latter was, in 1876, the project adopted. The construction of the breakwater was abandoned.

The project contemplated dredging the lower part of the shoal to 12 feet at low tide between the channel and the wharf line as far up as the wharf of the Boston and Bangor line of steamers, and from thence between the channel and the wharf line up to near Lane's Wharf to 10 feet at low tide. That project was completed in 1879, at a cost of $22,000.

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A new survey or examination of the harbor was ordered in the river and harbor act of August 11, 1888. This was made, and a new project adopted in 1890. The new project proposes to dredge a channel from the deep water at the entrance to the upper harbor, 250 to 300 feet wide and 15 feet deep at mean low tide; to dredge an area 8 feet deep on the north side of the harbor, so that vessels of that draft can reach the wharf in front of Pierce's ice house and mills at low tide; to dredge an area on the south side of the channel to a depth of 13 feet at mean low tide, to accommodate vessels touching at the Boston and Bangor Steamboat Company's Wharf. The estimated cost of the new project is $52,000.

The following appropriations have been made:

Act of—		Act of—	
August 14, 1876	$5,000	July 13, 1892	$10,000
June 18, 1878	12,000	August 17, 1894	8,000
March 3, 1879	5,000		
June 14, 1880	3,000	Total	53,000
September 19, 1890	10,000		

The total expenditures on Belfast Harbor up to June 30, 1894, were $45,000. At that date the 8-foot dredging near Pierce's Wharf had been completed, and the channel of entrance had been dredged to the full depth of 15 feet at mean low tide for a width of from 125 to 225 feet.

The expenditures during the last fiscal year were $2,360.54, making the total expenditures for this improvement $47,360.54.

In March, 1895, a contract was made with Hamilton & Sawyer, of Chebeague, Me., for dredging the channel of entrance and the area in front of the Boston Steamboat Wharf.

Work was commenced May 15, 1895, and by the close of the fiscal year the channel of entrance had been completed to the full width and a part of the area in front of the Boston Steamboat Wharf had been dredged.

Belfast is in the collection district of Belfast. The nearest light-house is Dice Head, near Castine.

Money statement.

Amount appropriated by act of August 17, 1894		$8,000.00
June 30, 1895, amount expended during fiscal year		2,360.54
July 1, 1895, balance unexpended		5,639.46
July 1, 1895, outstanding liabilities	$498.17	
July 1, 1895, amount covered by uncompleted contracts	4,893.31	
		5,391.48
July 1, 1895, balance available		247.98
Amount (estimated) required for completion of existing project		24,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		24,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for dredging in Belfast Harbor, Maine, February 18, 1895.

No.	Name and address of bidder.	50,000 cubic yards.	
		Price per cubic yard in scow.	Amount.
		Cents.	
1	Moore & Wright, Portland, Me.	19	$9,500
2	Hamilton & Sawyer, Chebeague, Me.	14½	7,375
3	Columbia Dredging Co., Fall River, Mass	19 3/16	9,600

Contract made with Hamilton & Sawyer, March 2, 1895.

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COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	1891.	1892.	1893.	1894.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Coal	10,710	10,800	10,900	11,230
Farm produce	910	915	820	840
Fertilizers	1,500	3,000	3,000	4,000
Grain	5,029	5,000	5,300	4,500
Hay	7,127	7,450	3,600	7,500
General merchandise	20,112	21,200	20,200	24,500
Lumber	3,400	2,900	2,500	3,300
Ice	13,000	88,000	5,000	4,800
Lime	1,325	1,410	1,200	.....
Stone	7,000	6,000	5,200	.....
Wood	980	850	750	910
Total	71,093	67,525	58,470	61,580

A 9.

IMPROVEMENT OF HARBOR AT CAMDEN, MAINE.

A survey was made of Camden Harbor in 1872 with a view to the improvement of its navigation, which, prior to that time, had been obstructed by the shoalness of the water over nearly all of its area, there being less than 12 inches depth over the most of it.

The first project was for regulating the entrance by dredging between the two principal steamboat wharves, which were located on opposite sides of the entrance; dredging a channel about 1,500 feet long, 100 feet wide, and 7 feet deep at mean low tide from the entrance up to the head of the wharves on the easterly side of the harbor, and a channel of the same width and depth, extending 1,400 feet up to the head of the wharves on the westerly side of the harbor. The total excavation required was about 90,000 cubic yards and the estimated cost $33,000. The total amount actually expended on the project was $30,000, and with the expenditure of this amount the project was completed in 1876.

In the river and harbor act of 1886 a new survey of Camden Harbor was ordered. This was made in 1887, and a project submitted for further improvement of the harbor. The dredged channels which had been made under prior appropriations, though they had not filled up to any appreciable extent, were not deep enough and wide enough to accommodate the increasing commerce. The new project contemplates: (1) The dredging of an area at the entrance to the harbor, and near the Boston Steamboat Wharf, to a depth of 12 feet at mean low tide; (2) the dredging of an area at the entrance, so as to afford more easy access to the harbor, to a depth of 10 feet at mean low tide; (3) the dredging of a channel along the wharf line on the west side of the harbor as far up as Alden's Wharf to a depth of 10 feet, and from thence up to the anchor factory and to Derow's shipyard to a depth of 5 feet at mean low tide; (4) the dredging of a channel on the east side nearly up to Gilkey's Wharf to a depth of 10 feet, and from thence up to Dailey's shipyard to a depth of 5 feet at mean low tide. These channels are to be about 50 feet wide at the upper end, where the depth is to be 5 feet, and about 100 feet wide where the depth is to be 10 feet.

The removal of the middle ground—that is, the space between the two channels—though desirable, was not regarded as an essential part of the project, and was not to be undertaken until the other parts had been completed. Subsequently its removal was included in the project.

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The estimated cost of the entire work was $60,000.

The following appropriations have been made:

Act of—		Act of—	
March 3, 1873	$10,000	July 13, 1892	$12,000
June 23, 1874	10,000	August 17, 1894	12,000
March 3, 1875	10,000	Total	65,000
August 11, 1888	5,000		
September 19, 1890	6,000		

The expenditure of the first three appropriations resulted in giving a good entrance to the harbor, and two channels, one on each side along the lines of wharves, not less than 6 feet deep at mean low tide.

The total expenditures up to the close of the fiscal year ending June 30, 1894, inclusive of both projects, amounted to $52,976.21.

As a result the dredging of the western channel, of the approach, and of the area near the Boston Steamboat Wharf had been completed, and about 400 feet of the 10-foot channel on the eastern side of the harbor had been dredged.

The expenditures during the last fiscal year were $17.50. No work was done.

A contract was made in March, 1895, with Hamilton & Sawyer, of Chebeague, Me., under which it is proposed to complete the dredging of the channels, and to remove so much of the middle ground, to the same depth as the adjacent channels, as the available funds will permit. The work will be done during the present season.

Camden is in the collection district of Belfast. The nearest light-house is on Negro Island, at entrance of harbor.

Money statement.

July 1, 1894, balance unexpended		$23.79
Amount appropriated by act of August 17, 1894		12,000.00
		12,023.79
June 30, 1895, amount expended during fiscal year		17.50
July 1, 1895, balance unexpended		12,006.29
July 1, 1895, outstanding liabilities	$50.00	
July 1, 1895, amount covered by uncompleted contracts	10,780.00	
		10,830.00
July 1, 1895, balance available		1,176.29
Amount (estimated) required for completion of existing project		25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals for dredging in Camden Harbor, Maine, February 18, 1895.

No.	Name and address of bidder.	60,000 cubic yards.	
		Price per cubic yard in scow.	Amount.
		Cents.	
1	Hamilton & Sawyer, Chebeague, Me	19¼	$11,550

Contract made with Hamilton & Sawyer, March 2, 1895.

COMMERCIAL STATISTICS.

It has been impracticable to obtain statistics for the year 1894.

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A 10.

IMPROVEMENT OF HARBOR AT ROCKLAND, MAINE.

The location of Rockland Harbor is such that, besides accommodating its own commerce, it affords a convenient refuge for large numbers of coasting vessels. When the project for a breakwater was adopted the harbor was open to easterly storms, the anchorage was unsafe, and the seas often broke over the wharves.

The following appropriations have been made for the improvement of Rockland Harbor:

Act of—		Act of—	
June 14, 1880	$20,000	September 19, 1890	$37,500
August 2, 1882	40,000	July 13, 1892	30,000
July 5, 1884	40,000	August 17, 1894	30,000
August 5, 1886	22,500		
August 11, 1888	30,000	Total	250,000

The project as originally adopted in 1881 provided for two breakwaters—one starting from Southwest Ledge, in the harbor, and running in a northerly direction toward Jameson Point, a distance of 2,640 feet, the other starting from Jameson Point and extending southward about 1,900 feet. The estimated cost was $550,000. The top of each breakwater was to be only 5 feet above the level of mean low tide.

In 1887 the project was amended so as to bring the top of the breakwater from Jameson Point to the level of high tide, leaving the other as originally designed. The estimated cost was thus increased to $650,000.

In 1890 the project was again modified. Instead of building the second breakwater from Southwest Ledge in a northerly direction, on which no work had been done, it was decided to prolong the one from Jameson Point in a southerly direction. By doing so a much larger area of the harbor would secure protection.

The estimated cost of the new project was $632,500, this being inclusive of the cost of the part already constructed.

Up to the close of the fiscal year ending June 30, 1894, there had been expended on the breakwater the sum of $218,995.50, and about 234,110 tons of stone had been placed in position, practically completing the work to a point 2,451 feet from the shore. The above expenditures had resulted in protecting a part of the harbor, giving a secure harbor of refuge for many vessels that trade near this port.

The expenditures during the year ending June 30, 1895, were $8,920.30.

In March, 1895, a contract was made with Joseph F. Curit, of Chebeague, Me., for continuing the construction under appropriation of 1894. Work was commenced on April 1, 1895, and has been in progress since, extending the breakwater about 150 feet. The contract, which covers about 50,000 tons of stone, is to be completed during the present season.

One thousand dollars of the amount appropriated by act of August 17, 1894, was available for expenditure in completing a survey of the harbor. The field work of this survey was about finished during June, 1895.

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Money statement.

July 1, 1894, balance unexpended		$1,004.50
Amount appropriated by act of August 17, 1894		30,000.00
		31,004.50
June 30, 1895, amount expended during fiscal year		8,920.30
July 1, 1895, balance unexpended		22,084.20
July 1, 1895, outstanding liabilities	$1.689.32	
July 1, 1895, amount covered by uncompleted contracts	19,100.76	
		20,790.08
July 1, 1895, balance available		1,294.12
Amount (estimated) required for completion of existing project		382,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		100,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for construction of breakwater in Rockland Harbor, Maine, February 18, 1895.

No.	Name and address of bidder.	Extension of breakwater (35,000 tons of stone).	
		Price per ton.	Amount.
		Cents.	
1	Joseph F. Curit, Chebeague, Me	56	$19,600
2	George Willett Andrews, Biddeford, Me	77	26,950
3	William S. White, Rockland, Me	56	19,600
4	Hamilton & Cleaves, Portland, Me	65	22,750

Contract made with Joseph F. Curit March 1, 1895.

COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	1891.	1892.	1893.	1894.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Brick, cement, and sand	8,897	42,904	36,614	39,275
Coal	33,505	42,480	51,000	63,000
Fish and salt, etc	2,569	8,257	9,908	9,578
Grain and flour	6,147	9,620	10,822	11,749
General merchandise	67,579	28,100	64,035	71,138
Hay and straw	.....	413	500	500
Lumber and ship timbers	24,376	27,680	29,190	28,742
Lime	160,000	97,785	130,000	116,000
Oil	.....	538	605	663
Stone	54,778	74,397	7,605	9,926
Sawdust and ashes	.....	6,071	5,404	5,642
Steel rails, iron work, and castings	.....	2,172	2,323	1,963
Wood and cooperage	76,237	188,388	188,500	147,357
Ice	4,672	.....	2,000	4,320
Total	433,760	528,805	538,566	509,853

Number of vessels arriving in calendar year 1894.

Steamers, coastwise:	
400 to 1,500 tons each	705
25 to 400 tons each	2,465
Sailing vessels:	
Foreign, average 84 tons each	445
Coastwise trade	3,474
For refuge only	1,100

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A 11.

IMPROVEMENT OF KENNEBEC RIVER, MAINE.

Congress recognized the importance of improving the Kennebec River as early as 1827, when an appropriation was first made. Appropriations aggregating $18,500 were made between 1827 and 1852. From 1852 to 1866 no work was done by the General Government, but the citizens of Augusta within this period undertook to dredge out a channel above Sheppards Point, and they improved it in some localities, but the material was not removed a sufficient distance from the channel, and from that and other causes it filled up again.

The act of June 23, 1866, appropriated $20,000 for the improvement of the upper part of the river between Sheppards Point and Augusta, a length of about 3 miles. The project for this improvement consisted in removing rocks and straightening and deepening the channel, which was obstructed by shoals, to a depth of 8 feet up to Hallowell and 7 feet from thence to Augusta. The estimated cost was $50,000. The projected width of channel was fixed at first at 75 feet.

In 1868, after a survey of the river had been made from Augusta to Gardiner, the project was amended so as to include all that part of the river from Gardiner to Augusta and the width fixed at 100 feet. The amended project was estimated to cost $80,000. In 1871 the project was again extended by act of Congress, which appropriated $5,000 for improving the river between Gardiner and Richmond. This part of the river it was proposed to improve so as to give 10 feet at low tide up to Gardiner. This necessitated the removal of a ledge near Nehumkeg Island, of ledges and bowlders at other points, the dredging of a channel through the Upper Sands Bar and one near the head of Swan Island. The estimated cost of this additional project was about $13,000.

By July 1, 1872, all the work contemplated in the various projects for improving the Kennebec from Richmond up to Gardiner had been completed. There were, however, several rocks in the main channel of the river at Lovejoy Narrows, on the east side of Swan Island, which were a source of danger to shipping. One of them, known as "Half-tide Rock," had been excavated to a depth of 8 feet at low tide, but as this gave only about 13 feet at high tide it was not sufficient to accommodate commerce. In the report of the Chief of Engineers for 1872 the removal of some of these rocks to a depth of 12 feet at mean low tide was suggested, at an estimated cost of $13,500. A survey of two of the ledges was made in 1872, when it was found they were larger than was expected, so that the estimate was increased to $30,603.61. A more accurate survey was made in 1874 and other small sunken ledges were found. In that year the adopted project consisted in removing Ledges III, IV, V, and Dry Rock, all to a depth of 12 feet at mean low tide. Ledge I (Half-tide Rock) had been completed to 12 feet in November, 1873, and Ledge II was omitted from the project, as the removal of Dry Rock seemed to render the removal of Ledge II unnecessary.

In 1877 all the dangerous rocks in Lovejoy Narrows had been removed to a depth of 12 feet at mean low tide, which completed all projected improvements in the Kennebec River.

No further work was done on the river until 1880, when a survey was made in obedience to the requirement of the river and harbor act of June 14, 1880, of Richmond Harbor, at the head of Swan Island, with a view to its improvement. The project suggested for this improvement, which was adopted in 1881, was to give a navigable channel not

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less than 10 feet deep at mean low water on the shoals at the upper end of Swan Island and at Hatchs Rock, about 2 miles below, and 11 feet at the lower end of Swan Island, about 5 miles below the town of Richmond.

The estimated cost of the project was $20,500. This project was completed in 1883.

In the river and harbor act of 1886 a new survey of the Kennebec River was ordered at Bath and from Augusta to the lower end of Perkins Island. This survey was made in 1887, and a new project for the improvement of the river from Bath to Augusta was submitted. The project submitted consisted in removing the shoals at Beef Rock, at Hatchs Rock, and near South Gardiner by means of wing dams and training walls and dredging, the removal of rocks at Bath and at Lovejoy Narrows by blasting, and the dredging of a channel through the shoals between Augusta and Gardiner, and the removal of the old piers of the bridge at Hallowell. The depths were to be as follows: At Beef Rock Shoal 12 feet, at Hatchs Rock 9 feet, at Lovejoy Narrows 18 feet, at Upper Sands Bar 12 feet, at Hallowell Shoal 10 feet, and from thence to Augusta 8 feet, all at low tide. The estimated cost of the entire project was $410,500. In 1888, an appropriation of $75,000 having been made for the improvement of the Kennebec River, a project for the expenditure of the appropriation in improving Hatchs Rock and Beef Rock Shoals was approved. Subsequently, owing to dredging which had to be done, and which was not contemplated in the original project, the estimated cost of the entire improvement was increased to $428,500. All of the appropriation made by act of September 19, 1890, was also expended on Beef Rock and Hatchs Rock shoals, and the removal of the piers of the old bridge at Hallowell.

In August, 1892, the project was revised and a general project for the improvement adopted, as follows: For a channel depth of 13 feet up as far as Sands Island; 12 feet from thence to Hinckley Shoal, and 10 feet from thence to Augusta; a steamboat channel 9 feet deep west of Swan Island, and the removal of old bridge piers at Hallowell, all of the above depths being referred to mean low tide. The estimated cost of the revised project was $388,500.

The aim of the project is to be accomplished by dredging and contraction works at Beef Rock Shoal, Hatchs Rock Shoal, and Upper Sands Bar; dredging alone between Gardiner and Augusta, and rock excavation at Lovejoy Narrows.

The following appropriations have been made:

March 2, 1827	$4,000	March 3, 1873	$12,000
March 19, 1828	3,500	June 23, 1874	12,000
April 23, 1830	5,000	March 3, 1875	15,000
August 30, 1852	6,000	March 3, 1881	10,000
June 23, 1866	20,000	August 11, 1888	75,000
March 2, 1867	30,000	September 19, 1890	50,000
April 10, 1869	14,850	July 13, 1892	100,000
July 11, 1870	15,000	August 17, 1894	50,000
March 3, 1871	15,000		
June 10, 1872	8,000	Total	445,350

The total expenditures on the river up to June 30, 1894, were $358,969.17. The results accomplished may be stated thus:

Before the improvements were commenced the main channel from the foot of Swan Island to Gardiner (15 miles) was obstructed by a shoal at the foot of Swan Island, with only 10 feet of water on it at mean low tide; by dangerous ledges in Lovejoy Narrows; by a shoal below South Gardiner with only 8 feet of water on it at mean low tide; and by a ledge in the channel at Nehumkeg Island. By the close of the fiscal

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year 1894 this part of the river had been improved by dredging, contraction works, and removal of ledge, so as to give a good channel, 12 feet deep at mean low tide.

The steamboat channel to the westward of Swan Island had been improved by dredging and contraction works, so as to give a depth of 9 feet at mean low tide, where formerly the depth over the shoals was but 7½ feet.

The channel between Gardiner and Augusta (6½ miles) before improvement was obstructed by shoals having on them only 3½ feet at low summer tide, which is about 2 feet below the level of mean low tide. Subsequently this part of the river was deepened, and at the time of the adoption of the present project the available depth was about 6 feet between Gardiner and Hallowell and about 5 feet between the latter place and Augusta. By the close of the fiscal year 1894 the channel had been dredged to 12 feet at mean low tide up as far as Hinckley Shoal, and to 10 feet depth through that shoal, which is about 3½ miles below Augusta. Three old bridge piers had also been removed from the channel of the river at Hallowell.

The expenditures during the year ending June 30, 1895, were $12,958.80.

At the date of the last annual report the only work in progress was under a contract with Townsend & Olsen for removing ledge at Lovejoy Narrows. Operations were continued until the 16th of November, when they were suspended for the winter. At the date of suspension about 1,488 cubic yards had been taken out, and the work done had been of material benefit to navigation. Work under this contract was resumed in May, 1895, and is due to be completed during the present working season.

April 1, 1895, a contract was made with Moore & Wright, of Portland, Me., for redredging at Beef Rock, where some shoaling had taken place, for removing a small shoal near Independent Ice Company's ice house, and for dredging to 10 feet at mean low tide through Hallowell, Shepards Point, and Britts Shoals, which will give 10 feet to within about one-half mile of Augusta. The contractors began about the middle of May, 1895, and had the work in progress at the close of the fiscal year. It is to be completed during the present working season.

March 27, 1895, a contract was made with Rogers & Fitzpatrick, of Plattsburg, N. Y., for the ledge excavation at Lovejoy Narrows not already under contract. Work was commenced in May last, and is due to be completed during the present season.

The improvement is in the collection district of Bath, of which Bath is the port of entry. Fort Popham and the light-house on Pond Island are near the mouth of the river.

Money statement.

July 1, 1894, balance unexpended		$36,380.83
Amount appropriated by act of August 17, 1894		50,000.00
		86,380.83
June 30, 1895, amount expended during fiscal year		12,958.80
July 1, 1895, balance unexpended		73,422.03
July 1, 1895, outstanding liabilities	$2,270.41	
July 1, 1895, amount covered by uncompleted contracts	59,849.17	
		62,119.58
July 1, 1895, balance available		11,302.45
Amount (estimated) required for completion of existing project		113,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		60,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

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Abstract of proposals for dredging in Kennebec River, Maine, March 11, 1895.

No.	Name and address of bidder.	Price per cubic yard (in scow).		Amount.
		Beef Rock Shoal and near Independent Ice Company's ice house (28,000 cubic yards).	Hallowell, Shepards Point, and Britts shoals (115,000 cubic yards).	
		Cents.	*Cents.*	
1	Columbia Dredging Co., Fall River, Mass	28.7	32.9	$45,871
2	Moore & Wright, Portland, Me	24	29	40,070
3	Charles H. Souther, Boston, Mass	34	37	52,070

Contract made with Moore & Wright, April 1, 1895.

Abstract of proposals for removing ledge in Kennebec River, Maine, March 11, 1895.

No.	Name and address of bidder.	Removal of ledges at Lovejoy Narrows (1,501 cubic yards ledge).	
		Price per cubic yard in place.	Amount.
1	Townsend & Johnston, Somers Point, N. J	$15.00	$22,515.00
2	Townsend & Olsen, Boston, Mass	10.98	16,480.98
3	George Willett Andrews, Biddeford, Me	10.50	15,760.50
4	Rogers & Fitzpatrick, Plattsburg, N. Y	9.87	14,814.87

Contract made with Rogers & Fitzpatrick, March 27, 1895.

Abstract of contracts for improving Kennebec River, Maine, in force during the fiscal year ending June 30, 1895.

No.	Name and address of contractor.	Date of contract.	Subject of contract.	Price per cubic yard.
1	Townsend & Olsen, Boston, Mass	Feb. 7, 1893	Removal of ledges at Lovejoy Narrows.	$12.47
2	Rogers & Fitzpatrick, Plattsburg, N. Y.	Mar. 27, 1895	do	9.87
3	Moore & Wright, Portland, Me	Apr. 1, 1895	Dredging at Beef Rock Shoal	.24
			At Shepards Point, Hallowell, and Britts shoals.	.29

COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	1891.	1892.	1893.	1894.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Bricks	1,903	13,500	400	7,150
Coal	123,356	150,000	162,075	130,079
Cement and plaster	335	532	415	475
Grain	150	195	50	200
General merchandise	22,400	33,000	42,801	2,800
Granite and feldspar	12,000	12,000	7,550	16,150
Hay	13,255	16,500	2,750	2,987
Ice	846,165	925,000	657,700	1,007,000
Iron	830	465	2,360	1,650
Lime and fertilizers	245	.....	325	1,325
Lumber and ship timbers	186,523	111,953	91,286	35,433
Salt	2,212	.....	726	.....
Wood	1,100	.....	2,500	2,716
Total	1,210,474	1,263,145	970,938	1,207,965

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Vessels built during the year 1894, gross tonnage, 13,589.

Ship	1
Steamers	2
Schooners	8
Sloop	1

A 12.

IMPROVEMENT OF HARRASEEKET RIVER, MAINE.

Under the act approved March 3, 1881, a survey of Harraseeket River was made in July of that year, and a report was submitted by the engineer of the district in December.

The river empties into Casco Bay at Stockbridges Point, about 12 miles northeast of Portland. From Stockbridges Point up to Westons Point the depth of water is no less than 10 feet at mean low tide, with no obstructions to navigation. From Westons Point up to Freeport Landing, a distance of 4,500 feet, the depth diminished so that for the greater part of the distance the bottom of the river was 3½ feet out of water at mean low tide. The rise and fall of tides here is 9 feet. The project recommended in 1881 was the dredging of a channel not less than 60 feet wide and 3 feet deep at mean low tide up to Freeport, with a turning basin 180 feet wide at the head of the channel. The estimated cost of the improvement recommended was $13,000.

No appropriation was made for the work, however, and a new survey was ordered in the river and harbor act of 1888. A project for the improvement was submitted January 4, 1889. This project was on a somewhat larger scale than the one previously suggested, and contemplated a depth of channel of 5 feet at mean low tide, which would give about 14 feet at high tide. Work under this project, for which Congress had appropriated $26,000, was in progress, when by act of August 17, 1894, Congress made an additional appropriation of $5,000 to complete the improvement.

The project was then amended to include a central cut to a depth of 8 feet at mean low tide. The estimated cost of the project as amended is $31,000—the sum of the three appropriations.

The following appropriations have been made:

Act of—	
September 19, 1890	$10,000
July 13, 1892	16,000
August 17, 1894	5,000

The expenditures to the close of the fiscal year ending June 30, 1894, were $717. At that date work was in progress under a contract for doing all the 5-foot dredging covered by the project, having been commenced in June of that year.

The expenditures during the year ending June 30, 1895, were $16,122.86, making the total expenditures $16,839.86.

Dredging was continued until November 29, 1894, when work was suspended for the winter. At that date 93,932 cubic yards of material had been removed, giving a channel 90 feet wide, 5 feet deep at mean low tide, from the entrance to the basin at Freeport, and nearly completing the contract.

Proposals for doing the 8-foot dredging were opened February 18, and April 15, 1895, but in both cases were rejected, the lowest bids being 24½ cents and 24 cents per cubic yard, respectively. Bids were again

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invited and opened May 16, 1895, and a contract was made with Moore & Wright, of Portland, Me., at 17 cents per cubic yard, the work to be completed the present season.

Moore & Wright, who have contracts for all the dredging, resumed dredging on May 24, 1895, and the work was in progress at the close of the year. It is expected to complete the project during the present working season, giving a channel 90 feet wide, 5 feet deep at low tide, with a central cut about 70 feet wide and 8 feet deep at low tide.

The river is in the collection district of Portland and Falmouth. The nearest light-house is on Halfway Rock.

Money statement.

July 1, 1894, balance unexpended		$25,283.00
Amount appropriated by act of August 17, 1894		5,000.00
		30,283.00
June 30, 1895, amount expended during fiscal year		16,122.86
July 1, 1895, balance unexpended		14,160.14
July 1, 1895, outstanding liabilities	$1,843.82	
July 1, 1895, amount covered by uncompleted contracts	11,561.90	
		13,405.72
July 1, 1895, balance available		754.42

Abstract of proposals for dredging in Harraseeket River, Maine, February 18, 1895.

No.	Name and address of bidder.	30,000 cubic yards.	
		Price per cubic yard in scow.	Amount.
		Cents.	
1	Augustus B. Martin, Boston, Mass	30	$9,000
2	Charles H. Souther, Boston, Mass	24½	7,350

All bids rejected as being too high.

Abstract of proposals for dredging in Harraseeket River, Maine, April 15, 1895.

No.	Name and address of bidder.	40,000 cubic yards.	
		Price per cubic yard in scow.	Amount.
		Cents.	
1	Charles H. Souther, Boston, Mass	24	$9,600

Bid rejected as being too high.

Abstract of proposals for dredging in Harraseeket River, Maine, May 16, 1895.

No.	Name and address of bidder.	40,000 cubic yards.	
		Price per cubic yard in scow.	Amount.
		Cents.	
1	Columbian Dredging Company, East Boston, Mass	21¾	$8,700
2	Moore & Wright, Portland, Maine	17	6,800

Contract made with Moore & Wright, May 24, 1895.

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Abstract of contracts for dredging in Harraseeket River, Maine, in force during the fiscal year ending June 30, 1895.

No.	Name and address of contractor.	Date of contract.	Subject of contract.	Price per cubic yard.
				Cents.
1	Moore & Wright, Portland, Me.....	Oct. 24, 1893	Dredging channel from Westons Point to Freeport Landing.	17½
2	.....do	May 24, 1895	.....do	17

COMMERCIAL STATISTICS.

No statement could be obtained.

A 13.

IMPROVEMENT OF PORTLAND HARBOR, MAINE.

The commercial importance of Portland was recognized in the early days when Congress began a system of internal improvements for the country. The first appropriations were made for the construction of a breakwater on Stamford Ledge, in Portland Harbor, according to the plan of John Anderson, of the Corps of Engineers, in 1836. Subsequent appropriations ran the aggregate up to about $166,000. The breakwater was completed in 1874, according to the plans of Col. B. S. Alexander, which plans had been submitted to and approved by a board of engineers consisting of Col. H. Bache, Lieut. Col. George Thom, and Maj. T. L. Casey in 1867.

The first regular appropriation for deepening the waters of the harbor was made in 1870, though by joint resolution of Congress, approved June 5, 1868, the Chief of Engineers was authorized to expend so much of the unexpended balance of the appropriation of 1866 for the breakwater as he might deem proper in excavating the middle ground near said breakwater and in otherwise protecting and improving the channel, so that the appropriation of 1866 for the breakwater and subsequent appropriations for improving Portland Harbor were expended partly on the breakwater and partly in dredging.

The first regular project for dredging the harbor was submitted by Col. George Thom June 30, 1868, in which he recommended the excavation of a channel 300 feet wide through the southern slope of the middle ground to the depth of 20 feet at mean low tide, and the removal of the bar off Grand Trunk wharves to the same depth. The project was approved. The estimated cost was $28,600.

The estimated cost of completing the breakwater at the time this report was made was $59,984, and as $92,000 of the appropriation of 1866 was at that time available no additional funds were needed over what had already been appropriated.

In 1869 an extension of the breakwater 190 feet was added to the project, and subsequently a further extension of 200 feet was ordered.

In 1870 the project for the channel improvement was amended so as to provide for a channel 400 feet wide instead of 300, and in 1871 it was still further added to by making it 500 feet wide, the extra cost of these additions to the project being $65,000.

The act of Congress of June 10, 1872, made an appropriation of $45,000 for Portland Harbor and Back Bay. The approved project for this latter improvement was estimated to cost $15,000. The improve-

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ment contemplated was the enlargement, by dredging, of the channel leading from Tukey's Bridge southwardly to the stone wharves.

In December, 1872, there was added to the project a plan to dredge the inner harbor to a depth of 16 feet up to the harbor commissioner's lines, beyond which several wharves extended. The estimated cost of this additional improvement was $110,000, but it was not designed to expend it until the outer ends of the projecting wharves had been removed. By 1876 all the work projected for the improvement of the harbor had been completed except the dredging in the inner harbor in front of the harbor commissioner's lines above Merrill's Wharf.

The total expenditures up to 1876 had been $306,908.07, which expenditures had been of great benefit to the commerce of the city.

No appropriation was made between 1875 and 1881.

A resurvey of the harbor was made in 1880, which showed that the dredged channels up to that time had not deteriorated.

A new appropriation was made in 1881, and with a view to the further improvement of the harbor a project and estimate for the removal of the entire area of the shoal known as the middle ground to a depth of 21 feet, at an estimated cost of $160,000, was adopted. The work on this latter project was continued until 1885, when it was completed. The total expenditures on the entire harbor up to June 30, 1885, were $427,929.21. In 1886 the board of trade and other parties interested asked for still further improvement of the harbor to a depth of 29 feet at mean low tide. A project for this improvement, at an estimated cost of $135,000, was approved in 1886. In 1890 the project was extended to include some dredging in the upper harbor to 16 feet, at an estimated cost of $5,000, making the total estimated cost of the project $140,000. In February, 1894, the project was amended so as to cover the widening of the upper end of the 29-foot channel, and the dredging of a 25-foot channel to connect the deep water in the lower part of the harbor with that in the upper part. The estimated cost of the project was not increased, there being a balance sufficient to meet the cost of the additional work.

The following appropriations have been made:

July 4, 1836, for breakwater	$10,000.00
March 3, 1837, for breakwater	25,000.00
July 7, 1838, for breakwater	26,366.00
June 23, 1866, for extending breakwater, but unexpended balance made available for excavating middle ground by joint resolution of June 5, 1868	105,111.05
July 11, 1870, for improving harbor	10,000.00
March 3, 1871, for improving harbor	40,000.00
June 10, 1872, for improving Portland Harbor and Back Bay	45,000.00
March 3, 1873, for improving harbor	50,000.00
June 23, 1874, for improving harbor	20,000.00
March 3, 1875, for improving harbor	20,000.00
March 3, 1881, for improving harbor	20,000.00
August 2, 1882, for improving harbor	35,000.00
July 5, 1884, for improving harbor	30,000.00
August 5, 1886, for improving harbor	30,000.00
August 11, 1888, for improving harbor	40,000.00
September 19, 1890, for improving harbor	40,000.00
July 13, 1892, for completing improvement	30,000.00
Total	576,477.05

The total expenditures up to June 30, 1894, were $551,721.65.

Before the improvement of the harbor was begun the greatest depth at mean low tide across the bar between the middle ground and Stamford Ledge was 16 feet, while the depth on the middle ground itself was

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only from 8 to 10 feet at mean low tide. The depth in the inner harbor along the front of the wharves was in places no more than 4 feet. The expenditures have resulted in removing the entire area of the middle ground up to the harbor commissioner's line, giving a wide and commodious entrance 29 feet deep at mean low tide; also in giving a depth of 16 feet at mean low tide within the inner harbor along the wharves and up to the harbor commissioner's lines, and a breakwater to protect the anchorage.

The expenditures in the fiscal year ending June 30, 1895, have been $24,755.40.

The operations during the fiscal year just ended consisted in widening the upper end of the 29-foot channel, and in dredging a 25-foot channel to connect the deep water in the lower part of the harbor with the deep water above, under contract with Moore & Wright.

Dredging was commenced on the 4th of September and was completed on the 28th of the following November, when 145,740 cubic yards of material had been excavated and removed, completing the contract.

The total quantity of dredging done in the harbor is about 1,853,791 cubic yards. The total quantity of stone built in the breakwater is about 45,000 tons.

The project is completed.

The harbor is defended by Forts Preble, Gorges, Scammel, and a battery at Portland Head. There is a light-house on the breakwater and one at Portland Head, 3 miles distant from the city. The harbor is in the collection district of Portland and Falmouth, of which Portland is the port of entry.

Money statement.

July 1, 1894, balance expended	$24,755.40
June 30, 1895, amount expended during fiscal year	24,755.40

COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	1891.	1892.	1893.	1894.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Apples	107,801	5,733	2,662	7,052
Bacon, pork, and provisions	810	18,700	18,640	19,566
Bricks	4,675	7,350	6,750	1,025
Coal	600,000	600,000	621,930	517,152
Cattle on hoof	3,185	3,512	733	5,466
Cement and lime and pipe	14,915	17,165	6,001	4,036
Cotton	2,874	3,815	5,000	2,175
Cooperage	2,345	5,514	4,858	13,926
Fish	13,052	10,000	52,875	54,830
General merchandise	482,626	377,417	282,205	272,493
Grain and hay	29,936	91,970	111,131	89,702
Ice	6,154	26,637	1,000	40,000
Iron, machinery, and castings, lead and tin	2,773	7,650	37,462	11,431
Lumber and carriage wood	39,162	65,328	74,950	46,526
Molasses and sugars	.....	8,360	2,782	4,111
Miscellaneous and dry goods	20,000	73,227	36,494	25,827
Oil and paints	20,862	26,531	36,000	26,000
Sand, stone, clay, and whiting	16,703	22,455	23,969	37,156
Salt, brimstone, and rags	364	4,766	5,635	1,975
Railroad ties	.....	685	.....	4,142
Printing paper and china clay	.....	.....	101,728	30,296
Total	1,368,237	1,376,815	1,432,805	1,214,887

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Arrivals in calendar year 1894.

Steamers:	
Coastwise, drawing 12 to 18 feet, average 1,500 tons	*845
Foreign, drawing 19 to 26 feet, average 2,500 tons	45
For refuge	42
Sailing vessels:	
Drawing 10 feet or more, average 500 tons	3,100
Drawing 10 feet, and less, average 100 tons	4,800
For refuge	1,800

A 14.

IMPROVEMENT OF CHANNEL IN BACK COVE, PORTLAND, MAINE.

The first work done in Back Cove was ordered in the river and harbor act of 1872. The project was for dredging a channel in "Back Bay" 100 feet wide and 8 feet deep at mean low tide, from Turkeys Bridge to the "Stone-shed wharves." The estimated cost was $15,000. The work was completed in January, 1874.

The act of August 5, 1886, appropriated $26,250 for continuing the improvement of Back Cove. A survey was made in 1886, and a project adopted having in view the straightening and deepening of the channel to a depth of 12 feet at mean low tide and to a width of 300 feet, following the harbor commissioner's lines along that part of the cove which borders the city, a distance of about 5,600 feet, with a turning basin at the upper end. The estimated cost of this project was $181,000, which, in 1888, was revised in consequence of a trifling modification in the location and put at $180,000. This project is now in process of execution.

The following appropriations have been made:

Act of—	
June 10, 1872, for improvement of Portland Harbor and Back Bay	$45,000
August 5, 1886	26,250
August 11, 1888	25,000
September 19, 1890	25,000
July 13, 1892	20,000
August 17, 1894	20,000

When work under the existing project was commenced the channel had a depth at low tide of about 8 to 10 feet for about one-half its length; in portions of the remaining length the depth at low tide did not exceed 1 foot.

The expenditures to the close of the fiscal year ending June 30, 1894, under the existing project, amounted to $76,535.13. At that date the condition of the work was as follows: The channel had been extended for a distance of about 1,400 feet to a width of 160 feet; about 1,400 feet to a width of 265 feet, and the remaining length to a width of 90 feet, with a turning basin 400 feet wide, at the upper end, all to the depth of 12 feet at mean low tide.

The expenditures during the fiscal year ending June 30, 1895, were $22,616.27.

Dredging was commenced July 9, 1894, under a contract with Charles W. Anthony, dated January 11, 1894, and was continued until the 5th of the following November, when 129,000 cubic yards of material had been removed and the contract closed.

* Does not include a number of smaller steamers which ply from Portland to points in Casco Bay, 3 to 14 miles distant.

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November 8, 1894, work was commenced under a contract made October 25, 1894, with Moore & Wright for continuing the dredging of the channel, and was in progress until November 28, when operations were suspended for the winter, after 20,000 cubic yards of material had been removed. Operations under this contract were resumed May 3, 1895, and were in progress at the close of the fiscal year.

The condition of the work is as follows: The channel has been dredged to its full width for about one-half its length and to a width of about 180 feet for the remaining length, all to the depth of 12 feet at mean low tide. A turning basin 400 feet wide has been dredged.

Back Cove is a part of Portland Harbor and is therefore in the same collection district; is defended by the same forts, and the same light-houses are near it as are given for Portland Harbor.

Money statement.

July 1, 1894, balance unexpended		$19,714.87
Amount appropriated by act of August 17, 1894		20,000.00
		39,714.87
June 30, 1895, amount expended during fiscal year		22,616.27
July 1, 1895, balance unexpended		17,098.60
July 1, 1895, outstanding liabilities	$530.00	
July 1, 1895, amount covered by uncompleted contracts	16,500.00	
		17,030.00
July 1, 1895, balance available		68.60
Amount (estimated) required for completion of existing project		63,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals for dredging in Back Cove, Portland Harbor, Maine, October 15, 1894.

No.	Name and address of bidder.	120,000 cubic yards measured in scow.	
		Price per cubic yard.	Amount.
		Cents.	
1	Charles W. Anthony, Fall River, Mass.	16.8	$20,160
2	Moore & Wright, Portland, Me.	16.5	19,800

Contract made with Moore & Wright, October 25, 1894.

Abstract of contracts for improving Back Cove, Portland Harbor, Maine, in force during fiscal year ending June 30, 1895.

No.	Name and address of contractor.	Date of contract.	Subject of contract.	Price per cubic yard.
				Cents.
1	Charles W. Anthony, Fall River, Mass*	Jan. 11, 1894	Dredging channel	14.2
2	Moore & Wright, Portland, Me.	Oct. 25, 1894	do	16.5

*Contract completed.

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COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	1891.	1892.	1893.	1894.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Bricks				350
Coal	11,586	35,771	34,063	45,314
Clay and sand	15,868	19,025	22,652	20,215
Granite	635			
Wood		125		
Railroad ties		560		414
Lumber				165
Pipe			3,050	760
Total	28,089	55,481	59,765	67,218

Number of arrivals in calendar year 1894.

Steamers drawing about 18 feet, 1,500 tons	1
Sailing vessels:	
Drawing about 18 feet, 1,000 to 1,500 tons each	5
From 12 to 16 feet, 500 to 1,000 tons each	51
About 10 feet, 250 to 500 tons each	39
About 8 feet, 100 to 200 tons each	3
Less than 8 feet, less than 100 tons each	125
Barges, about 18 feet, 1,300 tons each	4
	228

A 15.

IMPROVEMENT OF SACO RIVER, MAINE.

The first appropriation made for the improvement of the Saco River was in 1827, when $7,000 was appropriated for the erection of piers, placing beacons and buoys, and removing obstructions at and near the entrance to the harbor. With the expenditure of these funds it appears that twelve piers were constructed within the river, the object of which was to keep vessels from drifting on to the rocks and ledges, and two outside piers, which were evidently intended for breakwaters. No further appropriations were made until 1866, when an appropriation of $40,000 was made for continuing the repairs of piers in the Saco River.

In 1866 a plan was proposed by Mr. George Davidson, of the Coast Survey, for the construction of two stone piers conducting the river to the sea in a northeasterly direction, at an estimated cost of $40,000. In the same year Maj. B. S. Alexander, of the Corps of Engineers, submitted a plan for the construction of a breakwater between the two outside piers, 2,915 feet in length, 12 feet above low tide, the outer face to be of cut granite and the inner of rubblestone, the estimated cost of which was $192,500. The project of Major Alexander was modified at the suggestion of Col. George Thom, Corps of Engineers, by adding to it the repairing and rebuilding of the inside piers, the total cost of the entire project being estimated at $211,701. The latter project was approved March 28, 1867, with the condition that the position of the breakwater should first be determined by a board of engineers. Such a board, consisting of Major Casey, Lieutenant-Colonel Thom, and Col. H. Bache, approved the location proposed by Major Alexander, Corps of Engineers. The estimated cost was subsequently increased to $270,000, and in 1868 to $320,000.

The project in 1868 was the construction of the breakwater at the mouth of the river, the removal of sunken rocks, and the rebuilding of

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some of the most important piers in the river. The coping or paving of the outer slopes of the breakwater was afterwards dispensed with, and some of the other work was apparently done at a lower cost than the estimates, so that the entire project was completed in 1873 at a total cost of $169,275.

Nothing more was done from 1873 to 1882. In the latter year a resurvey of the breakwater was ordered by act of Congress. This survey was made in 1883 under direction of Colonel Blunt, Corps of Engineers, and an estimate submitted for extending the breakwater out to Sharps Ledge, raising and repairing the one in existence, constructing another of less height on the south side of the entrance, and for dredging. The total estimated cost of the improvement was $356,000. The resurvey showed that the breakwater did not prevent the accumulation of sand on the south side of it, so that the bar had again become an obstruction.

In 1884 an appropriation of $15,000 was made for improving breakwater at mouth of Saco River and repairs to same. This was a single item in the foregoing estimate, and the improvements and repairs suggested were estimated to cost $70,000, so that the project for improvement at the mouth of the river became repairing and raising the existing breakwater to a height of 15 feet above mean low tide and a width of 12 feet on top.

The same act of Congress that made an appropriation for the breakwater ordered a preliminary examination and survey of Saco River. A report of this survey was submitted October 16, 1885, and a project for improving the navigation of the river proper from its mouth to the towns of Saco and Biddeford, at an estimated cost of $50,000, was suggested. This amount was expected to give a continuous channel of 6 feet at mean low tide to the head of navigation from the bar.

In 1886 two appropriations were made, one for the river proper and the other for the repair and completion of the breakwater. The same was done in 1888. In 1889 the engineer recommended that the two projects be combined in one. The revised estimate of the cost of the two was then put at $185,000—$30,000 to complete the breakwater and $155,000 to give 6 feet at mean low tide from the sea to Biddeford and Saco, at the head of navigation. This estimate included the construction of a jetty on the south side of the mouth of the river. The appropriation made in 1890 was understood to be for continuing work on the combined project.

The following appropriations have been made:

March 2, 1827, for piers, buoys, and removing obstructions at and near entrance	$7,000
June 23, 1866, for repairing piers	40,000
March 2, 1867, for improving river	40,000
July 25, 1868, for improving river	20,000
April 10, 1869, for improving river	22,275
July 11, 1870, for improving river	10,000
March 3, 1871, for improving river	15,000
June 10, 1872, for improving river	15,000
July 5, 1884, for breakwater	15,000
August 5, 1886, for breakwater	12,500
August 5, 1886, for improving river	12,500
August 11, 1888, for breakwater	12,500
August 11, 1888, for improving river	10,000
September 19, 1890, for improving river, including breakwater and jetty	65,000
July 13, 1892, for improving river, including breakwater	25,000
August 17, 1894, for improving river, including breakwater	10,000
Total	331,775

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The total expenditures on both river and breakwater up to June 30, 1894, were $307,061.82.

The river before the improvement was begun was obstructed at its mouth by a bar on which there was only about 2 feet of water at low tide, though much of the river was deeper, and by ledges and bowlders. The swift currents also tended to sweep vessels on the rocks and ledges.

The expenditures to June 30, 1894, resulted in removing the dangerous ledges; constructing piers against which vessels could touch without danger of damage; in deepening the channel at Little Islands, Cow Island, and Factory Island by dredging, ledge excavation, and the establishment of contraction works; the construction of a substantial breakwater on the north side of the entrance, and the construction of a jetty to contract the channel way on the south side.

The expenditures during the fiscal year ending June 30, 1895, have been $13,950.39.

In July, 1894, a contract was made with Moore & Wright for dredging the channels at Factory Island and at and near Cow Island. Work was commenced early in July, and by the last of August 44,175 cubic yards of material had been removed, completing the contract, and giving the full depth of 6 feet at mean low tide.

A contract was made March 9, 1895, with William S. White, of Rockland, Me., for raising the places in the jetty where it had settled, and for raising the inner end of the breakwater, or north jetty, to full section. The contractor commenced late in April, 1895, and the work was in progress at the close of the fiscal year.

The channel through the bar at the mouth has deepened since the construction of the jetty, and it is expected that the depth will be maintained.

Saco River is in the collection district of Saco, Me., of which Saco is the port of entry. The nearest light-house is Wood Island.

Money statement.

July 1, 1894, balance unexpended		$14,713.18
Amount appropriated by act of August 17, 1894		10,000.00
		24,713.18
June 30, 1895, amount expended during fiscal year		13,950.39
July 1, 1895, balance unexpended		10,762.79
July 1, 1895, outstanding liabilities	$464.29	
July 1, 1895, amount covered by uncompleted contracts	6,357.15	
		6,821.44
July 1, 1895, balance available		3,941.35
Amount (estimated) required for completion of existing project		62,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		40,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals for placing stone in breakwater and in jetty, mouth of Saco River, Maine, February 18, 1895.

No.	Name and address of bidder.	10,000 tons stone for breakwater and jetty.	
		Price per ton.	Amount.
1	Joseph F. Curit, Chebeague, Me.	$1.25	$12,500
2	George Willett Andrews, Biddeford, Me.	1.13	11,300
3	William S. White, Rockland, Me.	.90	9,000
4	Hamilton & Cleaves, Portland, Me.	1.04	10,400

Contract made with William S. White March 9, 1895.

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Abstract of contracts for improving Saco River, Maine, in force during fiscal year ending June 30, 1895.

No.	Name and address of contractor.	Date of contract.	Subject of contract.	Price.
				Cents.
1	Moore & Wright, Portland, Me.*...	July 7, 1894	Dredging channel near Biddeford and Cow Island.	†20
2	William S. White, Rockland, Me....	Mar. 9, 1895	Placing stone on breakwater and jetty at mouth of river.	‡90

* Contract completed. † Per cubic yard ‡ Per ton.

COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	1891.	1892.	1893.	1894.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Bricks	6,000	6,100	9,700	9,840
Coal	40,724	39,266	48,962	35,780
Cement and lime	485	360	249	1,056
Iron	1,684	972	453	236
Lumber	80	120	.....	67
Molding sand	480	250	272	278
Powder and ashes	92	.....	.....	.....
Roofing gravel	220	40	101	93
Phosphate	.....	.....	28	.....
Total	49,765	47,108	59,765	47,350

In calendar year 1894, 157 vessels arrived; average draft, 11½ feet; tonnage, 27,632 tons.

A 16.

IMPROVEMENT OF BELLAMY RIVER, NEW HAMPSHIRE.

The Bellamy River to the head of navigation is a tidal branch of Great Bay, which empties into the Piscataqua River at Dover Point, 4 miles above the bridge at Portsmouth, N. H. At low water the channel of the river is too shoal for any navigation except for a short distance from its mouth. The distance over which improvements are projected is about 2½ miles.

A survey was made of the Bellamy River in 1887 and a project of improvement suggested at an estimated cost of $28,000, which was increased in 1891 to $35,000. The project is to secure a channel 50 feet wide and 5 feet deep at mean low tide from the mouth of the river up to Sawyer's Mill at Dover. The rise and fall of the tide being about 7 feet, a high-water navigation of 12 feet will be secured.

The above project was adopted in 1888, and its execution is now in progress.

The following appropriations have been made:

August 11, 1888	$10,000
September 19, 1890	10,000
July 13, 1892	7,500
August 17, 1894	7,500

The expenditures up to the close of the fiscal year ending June 30, 1894, have been $19,681.61. These expenditures have resulted in giving a channel from the mouth of the river up to about 1 mile above

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Robert's brickyard 50 feet wide and 5 feet deep at low tide. In other words, about 1 mile was added to the navigable part of the river.

The expenditures during the fiscal year ending June 30, 1895, were $11.60. There were no operations.

Proposals for dredging were opened February 18, 1895, but the prices being high the bids were rejected.

The work was readvertised, and the bids opened April 15, 1895. A contract was made with Columbian Dredging Company, of East Boston, Mass., at 23 cents per cubic yard, the work to be done during the present season.

Money statement.

July 1, 1894, balance unexpended		$7,818.39
Amount appropriated by act of August 17, 1894		7,500.00
		15,318.39
June 30, 1895, amount expended during fiscal year		11.60
July 1, 1895, balance unexpended		15,306.79
July 1, 1895, outstanding liabilities	$50.00	
July 1, 1895, amount covered by uncompleted contracts	13,800.00	
		13,850.00
July 1, 1895, balance available		1,456.79

Abstract of proposals for dredging in Bellamy River, New Hampshire, February 18, 1895.

No.	Name and address of bidder.	70,000 cubic yards, measured in scow.	
		Price per cubic yard.	Amount.
		Cents.	
1	Augustus R. Wright, Portland, Me.	34½	$24,150
2	Augustus B. Martin, Boston, Mass.	29	20,300

All bids rejected as being too high.

Abstract of proposals for dredging in Bellamy River, New Hampshire, April 15, 1895.

No.	Name and address of bidder.	70,000 cubic yards, measured in scow.	
		Price per cubic yard.	Amount.
		Cents.	
1	Columbian Dredging Co., East Boston, Mass.	23	$16,100
2	A. B. Martin, Boston, Mass.	27	18,900

Contract made with Columbian Dredging Company April 26, 1895.

COMMERCIAL STATISTICS.

Receipts and shipments in 1894.

	Tons.
Apples	19
Bricks	11,400
Wood	1,250
Total	12,669

No record of vessels arriving and departing.

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A 17.

IMPROVEMENT OF COCHECO RIVER, NEW HAMPSHIRE.

The Cocheco River is a branch of the Piscataqua, which empties into the sea at Portsmouth, N. H. Dover is the head of navigation, and here the mean rise and fall of tides is about 7 feet.

From Dover to the Lower Narrows, a distance of about 1½ miles, the river was much obstructed by bowlders, ledges, and shoals, the depth of water being only from 6 inches to 2 feet at mean low tide. Appropriations amounting to $10,000 were made as early as 1836 and 1837 "for deepening the channel of the Cocheco branch of the Piscataqua, leading into Dover Harbor," but the records do not show what work was accomplished.

The first regular project for the improvement of the river was based on an examination made in 1870, and consisted in making a channel not less than 40 feet wide and 4 feet deep at mean low tide from the Lower Narrows up to Collins's Wharf, at the head of the Upper Narrows. The estimated cost of the project was $45,000.

Subsequently, more accurate and extended surveys having shown the practicability of extending the improvement up to Packets Landing and thence to make a channel 2 feet deep at low tide, corresponding to 9 feet at high tide, and a width of 30 feet up to the bridge at the head of navigation, the estimate was increased to suit the latter project to $85,000. This sum was appropriated between 1871 and 1878, and by 1879 all the improvements at that time contemplated were completed.

These improvements opened up a large commerce, employing large vessels where formerly flatboats had been used. Owing to the abrupt turns, however, in the channel at the Lower Narrows these vessels had difficulty in passing that place. The larger vessels that came into use required a wider and deeper channel.

A new project was therefore adopted providing for making a cut-off channel through Alleys Point, with straight connecting channels above and below, and widening to 60 feet, and deepening to 5 feet the existing channels through Trickeys and Clements Point shoals; $28,000 was appropriated and expended in making the "cut-off" through Alleys Point. The other work of blasting and removing rock and dredging in the upper portions of the river was estimated to cost $47,000 more. This second project was completed in 1888.

The act of August 11, 1888, ordered another survey to be made of the river. The report of this survey is dated December 14, 1889. The large increase in trade seemed to justify still further improvement of the river, and accordingly a new project was submitted, suggesting an improvement that looks to obtaining a channel depth of 7 feet, increasing to 7½ feet in rock, the channel to have a minimum width of 50 feet where confined in rock, increasing to 60 and 75 feet where the material is less expensive to remove. This last project is estimated to cost $175,000.

The following appropriations have been made for the improvement of this river:

July 4, 1836	$5,000	August 2, 1882	$28,000
March 3, 1837	5,000	July 5, 1884	28,000
March 3, 1871	10,000	August 5, 1886	10,000
June 10, 1872	10,000	August 11, 1888	9,000
March 3, 1873	10,000	September 19, 1890	25,000
June 23, 1874	10,000	July 13, 1892	15,000
March 3, 1875	25,000	August 17, 1894	15,000
August 14, 1876	14,000		
June 18, 1878	6,000	Total	225,000

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The total expenditures on the improvement of the river up to June 30, 1894, have been $195,018.68. These expenditures have resulted in giving a channel through the rocky bed of the river 5 feet deep and 40 feet wide in the narrowest parts, where before the depth was only from 6 inches to 2 feet. The upper end of the channel at Dover has been deepened to 7 feet at mean low tide for a length of 1,200 feet, with widths varying from 100 to 140 feet. Portions of the channel above and below Clements Wharf, of a total length of 600 feet, have also been dredged to the same depth.

The expenditures during the fiscal year ending June 30, 1895, have been $14,099.09.

At the date of the last Annual Report work was in progress under a contract with Rogers & Fitzpatrick for excavation of ledge in the Upper Narrows. The contract was completed early in December, 1894, when 2,078.86 cubic yards had been removed, completing about 350 feet of the channel through the Upper Narrows to the full projected width and depth.

Proposals for continuing the ledge excavation at the Upper Narrows, under the appropriation of 1894, were opened February 18, 1895, and a contract was made with Andrew W. Bryne, of West Medford, Mass., at $6.20 per cubic yard, about 2,400 cubic yards to be taken out and the work to be finished by the close of the present working season.

The contractor began work in April, 1895, and by the close of the fiscal year had made considerable progress in drilling and blasting, though none of the material had been actually removed.

The improvements in the navigation of the Cocheco have been of great benefit to the people of Dover and the vicinity.

Money statement.

July 1, 1894, balance unexpended		$14,981.32
Amount appropriated by act of August 17, 1894		15,000.00
		29,981.32
June 30, 1895, amount expended during fiscal year		14,099.09
July 1, 1895, balance unexpended		15,882.23
July 1, 1895, outstanding liabilities	$200.00	
July 1, 1895, amount covered by uncompleted contracts	14,880.00	
		15,080.00
July 1, 1895, balance available		802.23

Amount (estimated) required for completion of existing project	120,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

Abstract of proposals for removal of ledge in Cocheco River, New Hampshire, February 18, 1895.

No.	Name and address of bidder.	2,000 cubic yards ledge in place.	
		Price per cubic yard.	Amount.
1	John J. Fitzpatrick, Plattsburg, N. Y.	$7.73	$15,460
2	Robert H. Rogers, Plattsburg, N. Y.	7.15	14,300
3	Columbian Dredging Co., East Boston, Mass.	7.30	14,600
4	Andrew W. Bryne, West Medford, Mass.	6.20	12,400
5	George Willett Andrews, Biddeford, Me.	7.73	15,460
6	Townsend & Johnston, Somers Point, N. J.	9.47	18,940

Contract made with Andrew W. Bryne, March 2, 1895.

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Abstract of contracts for improving Cocheco River, New Hampshire, in force during fiscal year ending June 30, 1895.

No.	Name and address of contractor.	Date of contract.	Subject of contract.	Price per cubic yard in place.
1	Rogers & Fitzpatrick, Plattsburg, N. Y.*	Mar. 20, 1894	Removal of ledge in Upper Narrows.	$6.44
2	Andrew W. Bryne, West Medford, Mass.	Mar. 2, 1895	.....do	6.20

* Contract completed.

COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	1891.	1892.	1893.	1894.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Apples	150	.....	.....	130
Ashes	.....	.....	.....	105
Brick	40,056	40,000	31,500	31,000
Coal	26,656	27,855	29,983	24,780
Cement, lime, and plaster	1,810	1,950	2,025	3,500
General merchandise	.....	.....	200	1,500
Iron	390	.....	.....	.....
Lumber	1,500	1,600	3,000	2,000
Phosphate	150	150	225	250
Sand (molding)	100	80	.....	150
Wood	.....	.....	.....	5,000
Total	70,662	71,785	66,933	68,415

Vessels arriving in calendar year 1894.

Sailing vessels, coastwise:	
400 to 500 tons each	30
Less than 400 tons each	66
Steam tugs	3
Barges	1

A 18.

HARBOR OF REFUGE AT LITTLE HARBOR, NEW HAMPSHIRE.

At the instance of members of the Marine Society and the Board of Trade and other citizens of Portsmouth a survey of this harbor was made in 1882 by Col. George Thom, Corps of Engineers. The improvement desired at that time was to have the channel of entrance opened to a depth of 9 feet at mean low tide for a width of 100 feet and to have the inner basin enlarged to a width of 300 feet for a length of about 700 feet and the dredged channel and basin protected by a rubblestone breakwater. The estimated cost of the project was $33,000.

The act of Congress of July 5, 1884, directed a preliminary examination and survey to be made with a view to its improvement as a harbor of refuge. The examination was made in the latter part of the

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year 1884, and an enlarged project submitted for the improvement, the estimated cost of which was $150,000. The former project was not regarded by the district engineer as sufficient to accomplish satisfactory results, and the latter he regarded as too costly to justify the Government in undertaking it. The former project, however, was adopted in 1886, and its execution entered upon.

In 1887 the engineer recommended that the project be enlarged, as the old project did not seem to meet the needs of those interested. A new project was therefore suggested, providing for the construction of two breakwaters, one on the north side and the other on the south side of the entrance, and the dredging of an anchorage behind them of about 49 acres to a depth of 12 feet at mean low tide. The estimated cost of the enlarged project was $235,000, and the act of 1888 made an appropriation of $20,000 for the work on the enlarged plan.

In October, 1894, after the breakwaters had been completed and a part of the dredging accomplished, the project was amended by reducing the area of the anchorage to be dredged to about 40 acres instead of 49. At the same time the estimate was revised, and the cost of the entire work placed at $145,000.

Before the improvement was undertaken the depth of water in the harbor was only about 6 feet at low tide and the anchorage was small in area and exposed to the full force of the sea, which is heavy when the winds are strong from the northeast. The object of the improvement is to form a harbor of refuge for small coasters and other vessels that get caught outside and are unable to get into the harbor of Portsmouth on account of the strong ebb tide which sets out to sea. It is said that a number of wrecks have occurred which need not have happened if such a harbor had been in existence.

The following appropriations have been made:

August 5, 1886	$10,000
August 11, 1888	20,000
September 19, 1890	40,000
July 13, 1892	30,000
August 17, 1894	10,000

The total expenditures up to June 30, 1894, were $89,509.78. At that date the breakwater on the south side of the entrance had been completed, the construction of the breakwater on the north side of the entrance was in progress under contract, and a channel 300 feet wide, 9 feet deep at mean low tide for 100 feet of its width and 12 feet deep for the remaining width, had been dredged.

The expenditures during the fiscal year ending June 30, 1895, have been $9,231.34.

At the date of the last annual report the construction of the breakwater on the north side of the entrance was in progress under a contract with William S. White. The work was completed early in the following October.

February 18, 1895, proposals for continuing the dredging of the anchorage area were opened, and a contract was made with A. R. Wright, of Portland, Me., at 16 cents per cubic yard. The contractor began dredging June 8, 1895, and the work was in progress at the close of the year.

There is no commerce, properly considered as such, in Little Harbor. The work is intended as a harbor of refuge, and has already been used in cases of necessity by small coasters.

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Money statement.

July 1, 1894, balance unexpended		$10,490.22
Amount appropriated by act of August 17, 1894		10,000.00
		20,490.22
June 30, 1895, amount expended during fiscal year		9,231.34
July 1, 1895, balance unexpended		11,258.88
July 1, 1895, outstanding liabilities	$200.00	
July 1, 1895, amount covered by uncompleted contracts	10,000.00	
		10,200.00
July 1, 1895, balance available		1,058.88
Amount (estimated) required for completion of existing project		35,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		35,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals for dredging in Little Harbor, New Hampshire, February 18, 1895.

No.	Name and address of bidder.	80,000 cubic yards dredging.	
		Price per cubic yard in scow.	Amount.
		Cents.	
1	Columbian Dredging Co., East Boston, Mass.	24	$19,200
2	Augustus R. Wright	16	12,800
3	Charles H. Souther, Boston, Mass.	19⅞	15,900
4	Columbia Dredging Co., Fall River, Mass.	20⅛	16,240

Contract made with Augustus R. Wright March 4, 1895.

Abstract of contracts for improving Little Harbor, New Hampshire, in force during fiscal year ending June 30, 1895.

No.	Name and address of contractor.	Date of contract.	Subject of contract.	Price.
1	William S. White, Rockland, Me.*	Mar. 19, 1894	Construction of breakwater at Jerrys Point.	†$1.96
2	Augustus R. Wright, Portland, Me.	Mar. 4, 1895	Widening dredged area within the harbor.	‡.16

* Contract completed. † Per ton, for stone. ‡ Per cubic yard, for dredging.

(The harbor being for refuge only, there is no commerce belonging to or arriving thereat worthy of note.)

A 19.

PRELIMINARY EXAMINATION OF GLEN COVE HARBOR, MAINE.

[Printed in House Ex. Doc. No. 47, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1894.

SIR: I have the honor to submit the accompanying copy of report of October 13, 1894, by Lieut. Col. Peter C. Hains, Corps of Engineers, of the results of a preliminary examination of Glen Cove Harbor, Maine,

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or Clam Cove, as it is generally called, made to comply with the requirements of the river and harbor act of August 17, 1894.

It is the opinion of Lieutenant-Colonel Hains, concurred in by this office, that the locality is not worthy of improvement by the General Government.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF LIEUT. COL. PETER C. HAINS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Me., October 13, 1894.

GENERAL: In compliance with requirements of Department letter of August 20, 1894, I have made a preliminary examination of Glen Cove Harbor, Maine, and have the honor to submit the following report:

Glen Cove Harbor, so called, or Clam Cove, as it is generally called and named on the Coast Survey charts, is formed by an indentation in the line of the west shore of Penobscot Bay. It is situated about 2½ miles from the center of Rockland on the south, and about 3 miles from Rockport on the north. The name harbor can hardly be applied to this small sheet of water, less than 1,000 feet wide and not much more in length. Nearly one-half its area is dry at low tide, and it is wholly exposed to the sweep of the northeast winds across Penobscot Bay.

Rockland and Rockport are both sheltered harbors; the latter is a natural harbor in such winds, and the former is made so by a breakwater constructed at great expense by the Government.

The Rockland, Thomaston and Camden Street Railroad passes close along the west shore of the cove, and a power house for operating the same is established there.

The improvement desired is the dredging of a channel of approach from the deep water outside to the wharf of the Rockland, Thomaston and Camden Street Railroad Company, and the Knox Gas and Electric Light Company. Those companies, it is said, consume a large quantity of coal, which is at the present time landed in Rockland and transported by teams to the power station established on the shore of the cove. It is claimed that only light-draft vessels can reach the wharf, and that it is impracticable to do a mercantile business while the harbor remains in its present condition as respects depth of water. This is no doubt true. Only vessels of very light draft can reach their wharf, but that was well known at the time it was built. The cove has not filled up since the wharf was constructed.

That any manufacturing establishments would grow up in case the cove was deepened is very doubtful, notwithstanding any surplus of power that the electric company may have to dispose of. The country back of the cove is not suited to agriculture, and though a good limestone is found only a few miles back, the proximity of the two towns of Rockland and Rockport would not warrant us in expecting any development of the manufacture and shipment of lime from this cove.

If a harbor were constructed a breakwater to protect it would also be needed. In my opinion the harbors of Rockland and Rockport afford all the facilities that general navigation now calls for, and it is far more

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important that the Government should concentrate its appropriations on the important work of completing the breakwater at Rockland and otherwise improving it. There is a large commerce at the latter place, and there can be no question of the advisability of the Government expending money on its improvement.

The Rockland, Thomaston and Camden Street Railroad Company and the Knox Gas and Electric Light Company would be the sole beneficiaries at this time of any improvement in Glen Cove, and in my opinion it would be more economical for the Government to extend their wharf out to deep water than to bring deep water up to the wharf by dredging.

For the above reasons I am of the opinion that Glen Cove Harbor, Maine, is not worthy of improvement by the General Government.

Very respectfully, your obedient servant,

PETER C. HAINS,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

A 20.

PRELIMINARY EXAMINATION OF ROYALS RIVER, MAINE

[Printed in House Ex. Doc. No. 20, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1894.

SIR: I have the honor to submit the inclosed copy of report, dated October 15, 1894, by Lieut. Col. Peter C. Hains, Corps of Engineers, of the results of a preliminary examination of Royals River, from the village of Yarmouth to Casco Bay, Maine, made to comply with requirements of the river and harbor act of August 17, 1894.

It is the opinion of Lieutenant-Colonel Hains that the locality is worthy of improvement by the General Government to the extent of giving a navigable depth of 7 feet at mean low tide, which corresponds to a high-tide depth of about 16 feet, and that the survey necessary for preparation of plan and estimate of improvement will cost $800.

I concur in his views.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF LIEUT. COL. PETER C. HAINS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Me., October 15, 1894.

GENERAL: In compliance with requirements of Department letter of August 20, 1894, I have made a preliminary examination of Royals River, from the village of Yarmouth to Casco Bay, Maine, and have the honor to submit the following report:

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Royals River is a small stream with a narrow and crooked channel at low tide. The village of Yarmouth is located at the head of navigation, about 11 miles northeast of Portland, Me., and has a population of about 2,500. There is a pulp mill, a cotton mill, an electric power plant, and a sawmill located on the stream, within the limits of the village, which, together, give employment to about 400 or 500 persons. The pulp mill alone employs over 200.

The consumption of coal and other raw material for making pulp is quite large. Supplies for these mills are for the most part received by rail, two railroads—the Maine Central and the Grand Trunk—passing through the town, but large quantities of wood for pulp, as well as coal and other supplies, would come by water if the facilities of navigation were improved. The navigable depth of water to be found in the channel at the present time up to the village of Yarmouth is less than 5 feet (about 4½) at mean low tide, but for the greater part of the distance the depth exceeds this by several feet. The dredging of a few shoal places would thus add to the navigable depth of the entire length of the river. The mean rise and fall of tide is about 9 feet. In spring tides, however, the rise and fall is greater. With a mean rise of 9 feet, vessels drawing about 14 feet can reach the town from Casco Bay at high tide, and a moderate quantity of coal and other materials is brought by sail vessels drawing not more than that depth. There is also a line of steamers that run from Portland to Yarmouth, stopping at numerous places along the shore of Casco Bay. These steamers draw about 5½ feet, and during low tides they can not get within about one-half a mile of the town.

In 1871 and 1872 Congress appropriated $20,000 for the improvement of Royals River, which amount was expended in dredging near Yarmouth to the depth of 4½ feet at mean low tide, and in removing several ledges obstructing navigation.

In 1882 another appropriation of $10,000 was made, and that sum was applied to dredging a channel at Wolfes Point, about 1 mile below Yarmouth, where the channel had been filled by a landslide, and to constructing a small jetty at the same locality.

The improvement desired is the deepening of the channel in places where it is now obstructed, so that about 8 feet or more can be carried at mean low tide up to the town. It is doubtful, however, whether a depth exceeding 7 feet can be had at a cost that would justify the Government in undertaking the work.

In view of the above, I am of the opinion that Royals River, from the village of Yarmouth to Casco Bay, Maine, is worthy of improvement to the extent of giving a navigable depth of 7 feet at mean low tide, which corresponds to a high-tide depth of about 16 feet. It is believed that the commerce of the place will be considerably increased by such improvement. Formerly wooden ships of considerable size were built at Yarmouth, but it is not believed that any increase in depth of water will revive that industry.

The preparation of a project for such an improvement as is referred to above will require a survey of some parts of the river, the estimated cost of which is $800.

Very respectfully, your obedient servant,

PETER C. HAINS,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

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A 21.

PRELIMINARY EXAMINATION OF PARKERS HEAD HARBOR AND CHANNEL, MAINE.

[Printed in House Ex. Doc. No. 21, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1894.

SIR: I have the honor to submit the accompanying copy of report of October 17, 1894, by Lieut. Col. Peter C. Hains, Corps of Engineers, of the results of a preliminary examination of Parkers Head Harbor and channel, Maine, made to comply with the provisions of the river and harbor act of August 17, 1894.

It is the opinion of Lieutenant-Colonel Hains, concurred in by this office, that the locality is not worthy of improvement by the General Government.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF LIEUT. COL. PETER C. HAINS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Me., October 17, 1894.

GENERAL: In compliance with requirements of Department letter of August 20, 1894, I have made a preliminary examination of Parkers Head Harbor and channel, Maine, and have the honor to submit the following report:

Parkers Head Harbor—so called—is a large area of flats, most of which is bare at low tide, but it is said that quite a number of small schooners lay up there through the winter, and from this it gets the name harbor. The channel is a narrow passage of variable depth, extending through the flats from the main river to the village of Parkers Head, a distance of about 3,600 feet. The population of the immediate vicinity is said to be about 300 by some, and by others it is put at 70. The latter is doubtless the nearer. The country in the vicinity is not well adapted to agriculture. There is said to be a good granite and feldspar quarry back of the town, which would be worked and give additional employment to the people if there were opportunities for loading vessels at the wharf.

The means of communication with Bath, about 10 miles distant, is by wagon road and by the small steamer that runs during a portion of the year between Bath and Popham Beach, stopping at Parkers Head when the tide admits.

There are no mills or other manufacturing establishments, but there was a sawmill, which some years ago was destroyed by fire and never rebuilt.

There is a fresh-water pond of some 225 acres area, which has been formed by a dam thrown across the mouth of a small stream that emptied into the river. The waters of the harbor are salt, and on this account do not generally freeze in the winter. Vessels can, therefore,

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come up to the dam and load in winter with ice cut directly from the pond. There is no need, therefore, of ice houses for packing it—no waste in handling. The quantity shipped per annum has been from 7,000 to 30,000 tons, valued at about $1.25 per ton, but it is claimed that the shipments might be as much as 300,000 tons if there were better facilities for shipping it.

There are three ice runs or wharves that are built out from the dam, so that as many as three vessels can load at a time under favorable conditions. These ice runs are cheap, light structures, built on piles, and are now in a very dilapidated condition, giving evidence of lack of use. The approach to the ice runs or wharves is through a narrow channel which has for the most part a depth of 7 feet or more at low tide, but there is only about 4½ feet at the entrance, and the bottom is bare at low tide at the upper end. It is said that this channel has filled up in recent years, but it is difficult to see how any filling could have taken place, unless it was caused by mill waste which was allowed to run into the river from the old sawmill. It is claimed that the present depth is not sufficient, because it necessitates the use of small vessels for carrying the ice, entailing a higher rate of freight.

There is a small wharf, called the town wharf, near the site of the old sawmill, at which, when she can reach it, the small steamer that plies between Popham Beach and Bath lands passengers and freight. This she can only do when the tide is in, for the bottom of the river is bare at the end of the wharf before the tide is entirely out.

The improvements desired by the people in the vicinity are—

First. The deepening and straightening of the channel of approach to the ice runs at the dam, so that larger vessels can reach them; and

Second. The extension of the channel up to the town landing.

The cost of the first work would not be great. The ice pond referred to, as well as the ice runs, are the exclusive property of the Parkers Bay Ice Company, and that company has the sole right to cut and ship ice from the pond. No one else can cut or ship ice from it unless the privilege is bought from that company.

While the freight rates might be reduced somewhat by providing a channel of greater depth, and while employment in cutting ice would be given to a number of people in winter, the dredging of the channel of approach to the ice runs does not seem to me, under the circumstances, to be a work of national importance. It would not necessarily benefit anyone except the ice company.

As the rise and fall of tide at Parkers Head is about 9 feet, there exists already a navigable channel, giving a depth of about 13 to 14 feet at high tide, up to the ice runs.

I do not believe that any other industry would be benefited by said improvement, for there is no other at this time established there. The few inhabitants of the village are nearly all seafaring people.

In respect to the extension of the channel up to the town wharf, it would be cheaper for the Government to build a small wharf out to the existing channel rather than to cut a channel up to the existing wharf.

In view of the above, I am of the opinion that Parkers Head Harbor and channel are not worthy of improvement by the National Government.

Very respectfully, your obedient servant,

PETER C. HAINS,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

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A 22.

PRELIMINARY EXAMINATION OF CAPE PORPOISE HARBOR, MAINE.

[Printed in House Ex. Doc. No. 22, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1894.

SIR: I have the honor to submit the accompanying copy of report, dated October 26, 1894, by Lieut. Col. P. C. Hains, Corps of Engineers, giving results of preliminary examination of harbor of Cape Porpoise, Me., required by river and harbor act of August 17, 1894.

It is the opinion of Colonel Hains that Cape Porpoise Harbor is worthy of improvement, and in this opinion I concur.

It is estimated that the necessary survey will cost $600.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF LIEUT. COL. PETER C. HAINS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Me., October 26, 1894.

GENERAL: In compliance with requirements of Department letter of August 20, 1894, I have made a preliminary examination of harbor of Cape Porpoise, Me., and have the honor to submit the following report:

Cape Porpoise Harbor is located about halfway between the cities of Portland and Portsmouth. As a business place it is not of great importance, but as a harbor of refuge for small vessels in bad weather it is of great importance. It is inadequate for this purpose, however, because of the limited area of the anchorage, which is only about 300 feet wide and less than three times as long, shoaling up toward the inner end. On each side of this narrow strip of water are large areas of flats that are bare, or nearly so, at low tide, with steep banks at the edge of the channel. The tide rises and falls on an average about 9.5 feet.

Vessels anchoring on the flats at high tide ground when the tide falls. The consequence is that the deep water is in great demand. In order to accommodate as many vessels as possible, chains have been stretched across the channel, and to the middle of them moorings are attached. A vessel coming into the harbor must make fast to one of these moorings or go on the flats. The harbor is in consequence overcrowded, and frequently several vessels are compelled to make fast to a single mooring. This causes accidents, and the lack of room makes it difficult for them to get under way. If a vessel anchors on the flats at high tides he can only get off at high tide. If the tide is not up when she comes in she must anchor in the channel.

This harbor, bad as it is for lack of room, is resorted to by great numbers of fishermen and others. As many as eighty sail, it is said, have been seen to anchor in the harbor in bad weather; most of them had to anchor on the flats and ground when the tide went out.

There can be no doubt but that a harbor of refuge here would be of great benefit to the immense number of small coasters that pass close

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to Cape Porpoise in their trips north and south. Many of these vessels must, in the present condition of things, run for Portland or Portsmouth on the approach of a storm, and it is stated that in doing so quite a number are lost.

The harbor is easy of access, well protected from the prevailing storm winds, and only needs enlargement to make it available. There is a light-house on Goat Island, at the entrance. The depth of water is 9 feet on the bar at low tide, but the depth inside is greater.

It is not practicable to give a fair estimate of the amount of commerce to be benefited by such an improvement. There are now and have been for many years quite a number of small vessels engaged in fishing that hail from this port. Many of the Gloucester fishermen, it is reported, call at Cape Porpoise for bait. But the harbor is needed as a refuge for all coasters who are caught outside on the approach of bad weather, and the great number of vessels engaged in the coasting trade, most of which are small and unfit to stand out to sea, would find a harbor here of incalculable value.

In view of the above, I am of the opinion that Cape Porpoise Harbor is worthy of improvement. To prepare a project for such improvement will necessitate a survey, which it is estimated will cost about $600.

Very respectfully, your obedient servant,

PETER C. HAINS,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

A 23.

SURVEY OF MACHIAS RIVER CHANNEL, MAINE.

[Printed in House Ex. Doc. No. 253, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., January 23, 1895.

SIR: I have the honor to submit the accompanying copy of report of January 9, 1895, by Maj. D. P. Heap, Corps of Engineers, giving the results of survey of Machias River Channel, Maine, provided for by the river and harbor act of August 17, 1894.

This report shows that during the years 1873–1875 the sum of $32,000 was appropriated by Congress for work upon this stream, and Major Heap now recommends that its channel be widened to 125 feet with a depth of 7 feet at mean low water, except at and above Middle Rock. This greater depth will allow for shoaling after the work ceases, which will probably reduce the practicable depth to 6 feet. The work proposed is estimated to cost $50,244.25.

Major Heap reports that he is informed and circumstantial evidence shows that sawdust, shingle refuse, etc., are still thrown in the stream, and that until the law is strictly enforced in this regard periodical dredging will be needed to maintain the requisite depth of channel.

Attention is invited to the indorsement of the division engineer, Col. H. L. Abbot, Corps of Engineers, dated January 15, 1895, in which he expresses the opinion that the deposit of sawdust and slabs in the river

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should cease before the work should be prosecuted by the General Government.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF MAJ. D. P. HEAP, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Me., January 9, 1895.

GENERAL: I have the honor to submit the following report of a survey of Machias River channel, Maine, ordered by the river and harbor act of August 17, 1894.

This work was assigned, by Department letter of September 5, 1894, * * * to my predecessor, Lieut. Col. Peter C. Hains, Corps of Engineers, whom I relieved November 5, 1894.

Machias River extends from the town of Machias, at the head of navigation, to Machiasport, at its mouth, a distance of about 5 miles.

A survey made in 1872 showed that from its mouth to Machias it formerly had not less than 6 feet of water at mean low water, and about 19 feet at ordinary high water, the average rise and fall of the tide being 13.3 feet; that up to the mouth of East Machias River, 1 mile above Machiasport, it had, at the time of the survey, a good and unobstructed 18-foot channel, and thence to the drawbridge, about 1 mile farther, a good 12-foot channel at mean low water.

Above the drawbridge for about 2 miles the channel was not less than 6 feet deep and (except at one locality) 150 feet wide. Thence to the falls the channel was narrow and tortuous, having in places not more than 3 feet of water. In the middle, directly in front of the wharves at Machias, was a large rock, known as "Middle Rock," covering an area of 1,320 square yards in the plane of mean low water, and having a height of 7.2 feet above that plane, containing 1,083 cubic yards of ledge, or 1,553 cubic yards to a depth of 1 foot below that plane.

The project for improvement consisted of—

1. Removing Middle Rock to a plane not exceeding 1 foot below mean low water.

2. Opening a channel between Machias Falls and drawbridge, 150 feet wide and 6 feet deep at mean low water.

In 1876 this project was modified by diminishing the width of the channel to 100 feet, and by not extending the excavation at Middle Rock to a greater depth than one-half foot below the plane of mean low water. The project as modified was completed in 1877, and cost $32,000, being the amount appropriated by Congress during the years 1873, 1874, and 1875.

The shoals were caused chiefly by slabs, edgings, and sawdust thrown into the river from sawmills at and above Machias Falls, and by reference to the recent survey (blue print inclosed) it will be seen that the condition of the river, except at Middle Rock, does not vary greatly from what it was in 1872—the same causes having produced the same effects.

In order to so improve the river as to meet the requirements of commerce, I recommend that its channel be widened to 125 feet, with a depth of 7 feet at mean low water, except at and above Middle Rock,

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where the width will remain as shown on blue print.* This greater depth will allow for shoaling after the work ceases, which will probably reduce the practicable depth to 6 feet.

The following obstructions would have to be removed (shaded on blue print):

1. Shoal near drawbridge, mud and sawdust, mixed with logs and slabs, 1,800 cubic yards, at 35 cents	$630.00
2. Channel from Libby Head to Machias, mud, sawdust, edgings, and a few logs, 141,755 cubic yards, at 35 cents	49,614.25
	50,244.25

NOTE.—Material measured in scows, 25 per cent allowed for expansion.

In addition to the above there is a small shoal at the upper end of the railroad company's wharf (see blue print) which is somewhat in the way of swinging the *Frank Jones* at low tide, but is no obstruction to the general traffic. The *Frank Jones* is a merchant steamer of 1,400 tons, 260 feet long over all, 36 feet width of hull, 63 feet wide outside guards, and 9 feet draft. It would be a convenience to the *Frank Jones* to have this shoal removed to a depth of 12 feet, but as this improvement would not be for the general benefit, I do not recommend it. The estimated cost is—

Shoal near railroad company's wharf, probably mud and sawdust, 10,000 cubic yards, at 30 cents	$3,000.00

All dredged material should be deposited in deep water, about 3½ miles from Machiasport.

About $250,000 worth of lumber is shipped annually, and miscellaneous goods to about the same value are received to supply Machias and the surrounding country, of which it is the distributing center. At Marshfield, about 2 miles distant, a quarry for paving stone has been opened, and 10 to 15 cargoes are shipped annually.

The project contemplates allowing vessels of 16 to 18 feet draft to enter on ordinary high tide. This will satisfy the needs of vessel owners.

I am informed, and circumstantial evidence shows, that sawdust, slabs, edgings, shingle refuse, etc., are still thrown in the stream. Until the law is strictly enforced in this regard, periodical dredging will be needed to maintain the requisite depth of channel.

Copies of the river and harbor act approved September 19, 1890, prohibiting the above have been sent to the collector of customs, mill owners, and other interested parties.

Very respectfully, your obedient servant,

D. P. HEAP,
Major, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

(Through Col. Henry L. Abbot, Corps of Engineers, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, January 15, 1895.

Respectfully forwarded to the Chief of Engineers, United States Army.

I think that this project covers what is required; but consider that the deposit of sawdust and slabs in the river should cease before the work should be prosecuted by the General Government.

HENRY L. ABBOT,
Colonel of Engineers, Bvt. Brig. Gen., U. S. A.,
Division Engineer.

* Omitted. Printed in House Ex. Doc. No. 253, Fifty-third Congress, third session.

A 24.

SURVEY OF CARVERS HARBOR, MAINE.

[Printed in House Ex. Doc. No. 304, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., February 6, 1895.

SIR: I have the honor to submit the accompanying copy of report, dated February 2, 1895, by Maj. D. P. Heap, Corps of Engineers, of the results of a survey of Carvers Harbor, Maine, made to comply with the provisions of section 12 of the river and harbor act of August 17, 1894.

Major Heap presents two plans for improvement, the first contemplating the construction of a breakwater from Lanes Island to Green Ledge and dredging to 10 feet mean low tide the shaded area A shown on the accompanying tracing. The total cost of this plan is estimated by him to be $69,500. The second plan proposes dredging the shaded area A to a depth of 16 feet and omitting the breakwater; estimated cost of this plan, $64,000.

The former plan is, in Major Heap's opinion, the one to be preferred, as much greater advantages will be obtained with but slightly increased cost.

Attention is invited to the accompanying indorsement of February 4, by Col. H. L. Abbot, Corps of Engineers, division engineer, in which he expresses the opinion that the cost of the projected breakwater can not safely be estimated at less than $1 per ton. The cost of the first plan of improvement on this basis will be $102,300.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF MAJ. D. P. HEAP, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Me., February 2, 1895.

GENERAL: I have the honor to submit the following report of a survey of Carvers Harbor, Maine, ordered by the river and harbor act of August 17, 1894. This work was assigned by Department letter of September 1, 1894, to my predecessor, Lieut. Col. Peter C. Hains, Corps of Engineers.

Carvers Harbor is the harbor of Vinal Haven, on the island of that name, which is the largest and most southerly of the group known as Fox Islands, forming the southeasterly limit of Penobscot Bay. The sailing distance from Vinal Haven to Rockland, Me., is about 15 miles.

The harbor is well protected from all storms, and is much used by sail and steam craft as a harbor of refuge. The industry of Carvers Harbor is mainly the quarrying, cutting, and polishing of granite. Formerly sand was used for the latter purpose, but of late years has been abandoned, improved methods, such as the use of emery and oil and the oxide of tin having been introduced. The anchorage area, however, is limited, and during the last twenty years the statement is that the harbor has shoaled about 3 feet, this shoaling being attributed to the large

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quantities of sand formerly used in the polishing mills, to the washing down of the soil removed from the quarries, and to the dust and spawls taken from the stonecutter's sheds and dumped in large quantities along the shore.

The larger vessels, mostly 3-masted schooners, now freighting from this harbor, draw from 14 to 17 feet, and there is an earnest desire to have an anchorage provided for vessels of this draft at all or nearly all stages of the tide, the mean rise and fall of which is 9.3 feet. The depth now ranges from 8 to 3 feet at mean low tide, and should be deepened and the anchorage widened.

A large and safe anchorage with ample depth of water can be secured by building a breakwater from Lanes Island to Green Ledge, either in a direct line or so as to include the outlying ledges (see tracing), as may be found the more economical, in which case a depth of 10 feet at mean low tide over the shaded area would be sufficient, or by dredging to 16 feet over the shaded area A and omitting the breakwater.

The former plan is, in my opinion, the one to be preferred, as much greater advantages will be obtained with but slightly increased expenditure.

ESTIMATED COST.

First plan.

Dredging Carvers Harbor to 10 feet at mean low tide, area A, 100,000 cubic yards material, at 15 cents	$15,000.00
Engineering expenses and contingencies, 10 per cent	1,500.00
Constructing breakwater, Lanes Island to Green Ledge, 82,000 tons stone, at 60 cents	49,200.00
Engineering expenses and contingencies	3,800.00
Total	69,500.00

Second plan.

Dredging Carvers Harbor to 16 feet at mean low tide, area A, 325,381 cubic yards material, at 18 cents	$58,568.58
Engineering expenses and contingencies	5,431.42
Total	64,000.00

The higher price, 18 cents, is estimated in the latter plan, as the material gets harder at the greater depth, and the dredge has to lift it higher.

A copy of an extract from the report of Mr. A. C. Both, assistant engineer, who made the survey, is appended, and a tracing* of the harbor is inclosed.

Very respectfully, your obedient servant,

D. P. HEAP,
Major, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

(Through Col. Henry L. Abbot, Corps of Engineers, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, February 4, 1895.

Respectfully forwarded to the Chief of Engineers, United States Army.

It seems to me that 60 cents per ton for the proposed breakwater is a very low estimate. The least contract price paid at the Mount Desert

* Omitted. Printed in House Ex. Doc. No. 304, Fifty-third Congress, third session.

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breakwater has been 97 cents, and at the Rockland breakwater 73 cents. At the New Haven breakwater, where the haul is only about 12 miles and the contractor has an exceptionally good outfit, the least price has been 74 cents, the next lowest bid being 97 cents. At the Point Judith breakwater the price under a continuing contract is $1.27½.

I think the cost of the projected breakwater can not safely be estimated at less than $1 per ton, which will give quite different figures to the two projects.

HENRY L. ABBOT,
Colonel of Engineers, Bvt. Brig. Gen., U. S. A.,
Division Engineer.

REPORT OF MR. A. C. BOTH, ASSISTANT ENGINEER.

PORTLAND, ME., *February 1, 1895.*

SIR: I have the honor to report upon the survey of Carvers Harbor, Maine, made under your direction, in compliance with a requirement in the river and harbor act of August 17, 1894.

The survey was commenced December 7 and completed December 17, 1894. A tracing of the map of this survey, drawn to a scale of 1:3000, is herewith submitted.

* * * * * * *

The large quantities of dressed granite and granite paving blocks which are annually manufactured here are shipped in vessels drawing from 14 to 17 feet, and the harbor in its present condition affords a very small area only for the anchorage of a few of these vessels. After being finished loading at the wharves, at time of high water, these vessels are (unless the wind is favorable for going to sea at once) taken to this small deep-water anchorage to wait for favorable wind and tide.

During the year 1894, 218 cargoes of stone were shipped from Carvers Harbor, and 49 cargoes from Roberts Harbor and Greens Island, which latter vessels usually also anchor in Carvers Harbor to wait for a chance to go to sea. Fifty vessels have brought cargoes of merchandise, coal, wood, and lumber, and about 1,000 fishing and coasting vessels have anchored in Carvers Harbor during the year. This shipping at times crowds the harbor to its utmost capacity and many vessels otherwise ready to leave can not do so on account of being aground.

Upon the suggestion and great desire expressed by some of the leading business men of Carvers Harbor to add the deep-water area south of the entrance to Carvers Harbor by constructing a breakwater from Lanes Island to Green Ledge, I took a single line of soundings across from the nearest point of Lanes Island to Green Ledge, so as to have some data to determine the probable cost of such a breakwater. The area thereby made available for safe anchorage would be about twice as large as the anchorage which can be made available by dredging in Carvers Harbor. I have shown a proposed location of a breakwater between the nearest points of land (1,400 feet) along the line of soundings, but as there is quite a number of ledges a short distance south of this line, I feel assured that additional soundings will show that a much cheaper and by far better location of a breakwater can be found along the single dotted line running from Lanes Island across these ledges to Green Ledge.

This triangular location, with its vertex at the ledges, which latter already form the means of materially breaking the heavy seas, would admit of a reduction of the cross section of the breakwater, for the reason that the seas would run along the two wings and be broken obliquely, instead of breaking all at once upon the straight breakwater for its entire length. The construction of a breakwater at this place, owing to the abundance of suitable stone close at hand, can be done at a minimum cost for such work, and a large, safe, and deep anchorage would be made available, not only for the larger class of vessels freighting from this port, but also for many other coasting vessels seeking a safe anchorage during gales. Carvers Harbor would not then be crowded and would have ample room and facilities for the numerous smaller craft.

The improvement of Carvers Harbor may therefore be effected in two ways: First, to dredge Carvers Harbor to a depth of 16 feet at mean low water over the area marked A, or, secondly, to construct a breakwater from Lanes Island to Green Ledge, thereby making the large area of water north of the breakwater available as a safe harbor for the larger class of vessels, in which case Carvers Harbor would have to be dredged to a depth of 10 feet at mean low water only, for the accommodation of the

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smaller class of vessels. As the difference of cost of the two improvements is not large, with the probability of finding a location for the breakwater much cheaper and better than the one estimated for, it is believed that the latter improvement is much to be preferred.

ESTIMATED COST OF IMPROVEMENTS.

First improvement.

Dredging Carvers Harbor to a depth of 16 feet at mean low water over the area marked A on the accompanying map will require the removal of 325,381 cubic yards of material, measured in scows, at 18 cents per cubic yard	$58,568.58
Engineering expenses and contingencies	5,431.42
Total cost of improvement	64,000.00

Alternative improvement.

1. Dredging Carvers Harbor to a depth of 10 feet at mean low water over the same area as in first improvement, but limited westerly by the 10 feet contour, will require the removal of 100,000 cubic yards of material, measured in scows, at 15 cents per cubic yard		$15,000.00
Engineering expenses and contingencies		1,500.00
Total cost of dredging		16,500.00
2. Constructing breakwater from Lanes Island to Green Ledge will require about 82,000 tons of stone, at 60 cents per ton.	$49,200.00	
Engineering expenses and contingencies	3,800.00	
		53,000.00
Total cost of improvement		69,500.00

Very respectfully, your obedient servant,

A. C. BOTH, *Assistant Engineer.*

Maj. D. P. HEAP,
Corps of Engineers, U. S. A.

A 25.

SURVEY OF GEORGES RIVER, MAINE.

[Printed in House Ex. Doc. No. 236, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., January 21, 1895.

SIR: I have the honor to submit the accompanying copy of report of January 10, 1895, with map,* by Maj. D. P. Heap, Corps of Engineers, of the results of the survey of Georges River, Maine, from Thomaston to mouth, provided for by the river and harbor act of August 17, 1894.

Major Heap reports that the best method of improvement for this stream is to deepen the present channel to 16 feet at mean low tide for a width of 90 to 220 feet, and to repair the beacon opposite Browns Point. The estimated cost of this work is $30,000.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

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*Omitted. Printed in House Ex. Doc. No. 236, Fifty-third Congress, third session.

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REPORT OF MAJ. D. P. HEAP, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Me., January 10, 1895.

GENERAL: I have the honor to submit the following report of a survey of Georges River, Maine, made in compliance with section 12 of the river and harbor act of August 17, 1894, and instructions contained in letter from office of Chief of Engineers, United States Army, dated Washington, D. C., September 1, 1894.

The survey was made by Mr. A. C. Both, assistant engineer. I inclose a copy of his report and a blue print * of the survey.

The best method of improvement is to deepen the present channel to 16 feet at mean low tide for a width of 90 to 220 feet, as shown on blue print, and to repair the beacon opposite Browns Point. No improvement is needed below Point of Rocks.

The estimated cost and quantities of material are:

Dredging 133,555 cubic yards of material, measured in scows, at 20 cents	$26,711
Repairing stone beacon	250
	26,961
Engineering expenses and contingencies	3,039
Total	30,000

The depth of 16 feet is selected, as Thomaston is frequented by large schooners drawing, loaded, from 16 to 18 feet.

The improvement mentioned above would meet the present and prospective needs of commerce.

Very respectfully, your obedient servant,

D. P. HEAP,
Major, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

(Through Col. Henry L. Abbot, Corps of Engineers, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, January 15, 1895.

Respectfully forwarded to the Chief of Engineers, United States Army, recommended.

HENRY L. ABBOT,
Colonel of Engineers, Bvt. Brig. Gen., U. S. A.,
Division Engineer.

REPORT OF MR. A. C. BOTH, ASSISTANT ENGINEER.

PORTLAND, ME., *January 4, 1895.*

SIR: I have the honor to submit the following report upon the survey of Georges River, Maine, near Thomaston, made under your direction, in compliance with a requirement in the river and harbor act of August 17, 1894:

The survey was commenced on November 22 and completed on December 6, 1894. The map of this survey, drawn to a scale of 1:3000, is herewith submitted. The mean low-water level, to which the soundings shown on the map are referred, was obtained from a bench mark established by the United States Coast and Geodetic Survey. It is a drill hole in the north face of the stone beacon, and is 12.52 feet above the mean low-water level.

* Omitted. Printed in House Ex. Doc. No. 236, Fifty-third Congress, third session.

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On December 21, 1874, the bark *Levander*, Capt. Ambrose Vesper, ran into this beacon accidentally and dislodged a number of stones as far down as the fifth course from the top. Although no disarrangement of the stones forming the north face of this beacon is apparent, I have, in order to preserve this reference, established two more bench marks on shore, as shown on the map. The mean range of tides at Thomaston is 10 feet. The character of the material along the line of the channel was examined in fifteen places located on the map, and marked No. 1 to No. 15. The results of these tests, which were made with an iron rod 1 inch in diameter and 20 feet long, are tabulated on the map, and indicate that the bulk of the material necessary to be dredged consists of soft mud, except in the upper parts of the channel, where some soft clay and some rocks, sand, and gravel may be found.

The improvements (shaded on the map) which are recommended, and which it is believed will give ample facilities for the safe and unobstructed passage of the largest class of vessels now sailing to and from this port, are as follows:

Dredging a channel to a depth of 16 feet at mean low water, from deep water near the "Point of Rocks" to the head of the wharves at Thomaston, the total distance being about 4,500 feet, the widths of the channel in its several parts to be as follows:

1. A straight portion (A to B) from "Point of Rocks" to near the stone beacon (a distance of about 1,700 feet) to a width of 160 feet.
2. The curved portion (B to C) around the stone beacon (a distance of about 800 feet) from 160 feet, to a maximum width of 220 feet, diminishing to a width of 125 feet near Creighton's Wharf (at C).
3. A straight portion (C to D) in front of Creighton's and Cushing's wharves (a distance of about 1,000 feet) to a width of 125 feet.
4. A straight portion (D to E) from Cushing's Wharf to and in front of O'Brien's Wharf (a distance of about 1,000 feet) to a width of 90 feet.

It is also recommended that the stone beacon, which is a very substantial and well-built structure, be repaired. It will require the partial taking up and relaying of about five courses. The stones which were knocked off by the collision above mentioned are lying close by on the bottom and can be easily recovered at low water and replaced. No new stone will be required, as it is believed that no stone has been lost.

Estimated cost of improvement.

1. Dredging a channel from "Point of Rocks" (marked A) to the head of the wharves at Thomaston (marked E), for a total distance of 4,500 feet, having a depth of 16 feet at mean low water, and widths varying from 220 feet to 90 feet, will require the removal of 133,555 cubic yards of material, measured in scows, at 20 cents per cubic yard	$26,711	
2. Repairing the stone beacon at an estimated cost of $250	250	
		26,961
Engineering expenses and contingencies		3,039
Total cost of improvements		30,000

Very respectfully, your obedient servant,

A. C. BOTH, *Assistant Engineer.*

Maj. D. P. HEAP,
Corps of Engineers, U. S. A.

A 26.

SURVEY OF SASANOA RIVER, MAINE.

[Printed in House Ex. Doc. No. 142, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 19, 1894.

SIR: I have the honor to submit the accompanying copy of report of December 13, 1894, with two maps,* from Maj. D. P. Heap, Corps of Engineers, of the results of a survey of Sasanoa River, Maine, made

*Omitted. Printed in House Ex. Doc. No. 142, Fifty-third Congress, third session.

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to comply with requirements of the river and harbor act of August 17, 1894.

To give full 12 feet depth at mean low tide at Carletons Ledges, to widen the channel at Upper Hell Gate to 125 feet and to the same depth of 12 feet, and to construct a beacon on the jetty at Camp Ground, Major Heap submits estimates amounting to $19,000.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF MAJ. D. P. HEAP, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Me., December 13, 1894.

GENERAL: I have the honor to submit the following report of a survey of Sasanoa River, Maine, ordered by the river and harbor act of August 17, 1894. This work was assigned, by Department letter of September 5, 1894, * * * to my predecessor, Lieut. Col. Peter C. Hains, Corps of Engineers, whom I relieved November 5, 1894.

The Sasanoa River, formerly known as Back River, is a tidal river, or thoroughfare, about 9 miles in length, connecting the Kennebec River, at Bath, Me., with Sheepscot River, and does not extend to Boothbay, as mentioned in the act of Congress ordering the survey.

Between 1870 and 1881 the sum of $45,500 was appropriated by Congress, and this amount was expended in improving the navigation of the stream near its western end, under the title "Gut opposite Bath." The work consisted in rock excavation and dredging, including the construction of a small jetty, all in the vicinity of "Upper Hell Gate," a locality about 2 miles east of Bath, Me.

The chief business on the river is that carried on by the Eastern Steamboat Company, of Bath, Me. This company has five steamboats, varying from 80 to 120 feet in length, and drawing about 9 feet when loaded. During the season of 1893 the traffic by this line amounted to 41,000 passengers and 1,900 tons of freight, which figures were, I am informed, probably exceeded during the season of 1894.

The Kennebec and Bath Steamboat Company also runs during the summer a large excursion boat between Gardiner and Boothbay.

The Knickerbocker Towing Company, which does all the towing in that vicinity, is able to take only light schooners through the Sasanoa River, and finds the most difficulty at Upper Hell Gate, where the channel is narrow.

The waterway is also much used by scows and lighters carrying bricks and lumber, and occasionally by small schooners of about 150 tons.

The first obstruction to navigation after leaving Bath is at the draw of Arrowsic Bridge (shown on tracing). To the eastward of the draw opening the water is shoal, obstructing the approach. To remove enough of the shoal to afford easy access to the draw, giving a depth of 12 feet at mean low tide, would probably require the dredging of 6,000 cubic yards of material, and the channel so made would be liable to fill up again. The draw of the bridge is, however, improperly located.

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A new draw should be required to be opened, under the provisions of the act of September 19, 1890, about 150 feet north of the present one, so as to be over the natural channel of the river, where there is not less than 20 feet of water at mean low tide for a width of about 200 feet. In view of the above no dredging is recommended to be done by the General Government at this point.

The next obstruction occurs near and to the southward of Carletons Ledges at Ferry Point, where a shoal (shaded on tracing) extends nearly across the channel. To give 12 feet depth over this shoal at low tide would require the removal of about 2,000 cubic yards of sand and gravel.

The channel at Upper Hell Gate is about 100 feet in width and the tidal currents are strong. The channel should be widened to 125 feet to the depth of 12 feet at mean low tide, which would require the removal from the west side of the channel of about 900 cubic yards of ledge, measured in place. The proposed excavation is shaded in black on accompanying tracing.

The jetty at Camp Ground is submerged at high tide, and the outer end of it should be marked by a beacon.

To give full 12 feet depth at mean low tide at Carletons Ledges, to widen the channel at Upper Hell Gate to 125 feet and to the same depth of 12 feet, and to construct a beacon on the jetty at Camp Ground, which are the items of improvement recommended for the Sasanoa River, would, it is estimated, cost as follows:

Dredging at Carletons Ledges, 2,000 cubic yards, at 40 cents	$800
Ledge excavation at Hell Gate, 900 cubic yards, at $20	18,000
Beacon on jetty at Camp Ground	200
Total	19,000

The works of improvement above recommended are, in my opinion, all that are needed to meet the present or prospective needs of the commerce of "Sasanoa River from Bath to Boothbay, Me."

Two tracings, showing the localities recommended for improvement, are transmitted herewith. The survey near Arrowsic Bridge was made during October, 1894. The data for the tracing, showing the locality at and near Upper Hell Gate, is taken from a survey made in 1878, under the direction of Lieut. Col. George Thom. The conditions are practically unchanged, except that the shoal near Carletons Ledges has increased.

Very respectfully, your obedient servant,

D. P. HEAP,
Major, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

(Through Col. H. L. Abbot, Corps of Engineers, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, December 17, 1894.

Respectfully forwarded to the Chief of Engineers, United States Army.

I concur with Major Heap in regarding improvements as herein recommended as all that are needed to meet the present or prospective needs of the commerce of Sasanoa River from Bath to Boothbay, Me.

HENRY L. ABBOT,
Colonel of Engineers, Brt. Brig. Gen., U. S. A.,
Division Engineer.

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A 27.

ESTABLISHMENT OF HARBOR LINES IN ROCKLAND HARBOR, MAINE.

ROCKLAND, ME., *October 16, 1894.*

SIR: The undersigned citizens of Rockland, Me., respectfully represent that for the preservation and protection of the harbor of said city it is necessary that the lines beyond which wharves, piers, bulkheads, and other works shall not extend, shall be established. They therefore pray that you will take such action in the matter as you may deem expedient.

F. C. KNIGHT and others.

Hon. DANIEL S. LAMONT,
Secretary of War, Washington, D. C.

LEWISTON, ME., *November 9, 1894.*

I recommend that action be taken as within requested. Rockland is one of the most important harbors on the Maine coast.

N. DINGLEY, Jr., *M. C., Maine.*

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
November 13, 1894.

Respectfully referred to Maj. D. P. Heap, Corps of Engineers, for report under the provisions of section 12 of the act of Congress of September 19, 1890.

If, in the opinion of Major Heap, the establishment of harbor lines is essential to the preservation and protection of this harbor, he will submit a tracing with his report, showing the lines that should be established.

By command of Brig. Gen. Casey:

H. M. ADAMS,
Major, Corps of Engineers.

[Fourth indorsement.]

UNITED STATES ENGINEER OFFICE,
Portland, Me., January 15, 1895.

Respectfully returned to the Chief of Engineers, U. S. A.

I have the honor to report that I visited Rockland, Me., on the 7th instant and consulted with all parties interested in the wharf front.

In my opinion the establishment of harbor lines is essential to the preservation and protection of this harbor, and I inclose a tracing* showing the lines that should be established. These lines are so drawn as to conflict as little as possible with existing interests and at the same time not to interfere with the general navigation. There is no necessity at present of establishing the harbor lines north or south of the red line on the tracing.

No accurate survey was available, consequently the harbor lines as laid down are only a close approximation, but are sufficient for all practical purposes.

* Not printed.

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I expect to make a survey of the harbor in the spring, and, if so authorized, will include the wharf front in this survey and lay out the harbor lines with greater accuracy.

D. P. HEAP,
Major, Corps of Engineers.

[Fifth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
January 17, 1895.

Respectfully returned to the Secretary of War.

This is a request for establishment of harbor lines at Rockland, Me.

Inviting attention to the foregoing indorsement, I recommend that the harbor lines for this locality proposed by Maj. D. P. Heap, Corps of Engineers, and shown on the inclosed tracing, be approved.

The tracing submitted has been prepared for the signature of the Secretary.

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

[Sixth indorsement.]

WAR DEPARTMENT, *January 21, 1895.*

Respectfully returned to the Chief of Engineers, the inclosed tracing having been approved by the Secretary of War.

By order of the Secretary of War:

JOHN TWEEDALE, *Chief Clerk.*

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APPENDIX B.

IMPROVEMENT OF RIVERS AND HARBORS IN EASTERN MASSACHUSETTS.

REPORT OF LIEUT. COL. S. M. MANSFIELD, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1895, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Newburyport Harbor, Massachusetts.
2. Merrimac River, Massachusetts.
3. Powow River, Massachusetts.
4. Ipswich River, Massachusetts.
5. Essex River, Massachusetts.
6. Harbor of refuge, Sandy Bay, Cape Ann, Massachusetts.
7. Gloucester Harbor, Massachusetts.
8. Manchester Harbor, Massachusetts.
9. Salem Harbor, Massachusetts.
10. Lynn Harbor, Massachusetts.
11. Winthrop Harbor, Massachusetts.
12. Mystic and Malden rivers, Massachusetts.
13. Boston Harbor, Massachusetts.
14. Weymouth River, Massachusetts.
15. Hingham Harbor, Massachusetts.
16. Scituate Harbor, Massachusetts.
17. Plymouth Harbor, Massachusetts.
18. Kingston Harbor, Massachusetts.
19. Wellfleet Harbor, Massachusetts.
20. Provincetown Harbor, Massachusetts.
21. Chatham Harbor, Massachusetts.
22. Removing sunken vessels or craft obstructing or endangering navigation.

EXAMINATIONS AND SURVEYS.

23. Manchester Harbor, Massachusetts.
24. Plymouth Harbor, Massachusetts.
25. Chatham New Harbor, Massachusetts.
26. Chelsea River, Massachusetts.
27. East Boston Channel, Boston Harbor, Massachusetts.
28. Salem Harbor, Massachusetts.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., July 1, 1895.

GENERAL: I have the honor to transmit herewith annual reports for the works of river and harbor improvements in my charge for the fiscal year ending June 30, 1895.

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Lieut. Col., Corps of Engineers.

Brig. Gen. WM. P. CRAIGHILL,
Chief of Engineers, U. S. A.

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B 1.

IMPROVEMENT OF HARBOR AT NEWBURYPORT, MASSACHUSETTS.

Newburyport is situated on the south bank 2½ miles, approximately, from the mouth of the Merrimac River. The river empties into the Atlantic Ocean midway between Cape Ann and Portsmouth, or about 30 miles a little east of north from Boston in a direct line.

The outlet of the river, between Plum Island and Salisbury Point, is 1,000 feet wide and 30 feet deep at mean low water. At a distance of nearly a mile outside lies a sandy bar, thrown up by wave action, through which, previous to the improvement, a channel, variable in position and depth, was maintained by the current of the river, increased by the tidal prism in a large interior basin, due to a range of tides equaling 8½ feet.

For 1,000 feet outward from the gorge toward the crest of the bar the current was able to maintain a channel of navigable width and 18 feet deep at mean low water, and for a farther distance of 1,500 feet a channel 12 feet deep. From the 18-foot contour line on the inside to the same on the outside the distance was 4,000 feet, and between the 12-foot contours the distance was 3,000 feet.

The depth on the crest of the bar was generally less than 7 feet at mean low water.

The object of the improvement is to create through the outer bar a channel 1,000 feet wide and at least 17 feet deep at mean low water, so that vessels may cross the bar and find a harbor at any stage of the tide with as great draft as can reach Newburyport by the river at high tide.

The project submitted September 16, 1880, proposed two converging rubblestone jetties, their outer ends parallel for 1,000 feet and about the same distance apart, and the protection of the beach in their vicinity. This was modified in 1882 so as to provide for the partial closing of Plum Island Basin with a timber dike about 800 feet long and 5½ feet above mean low water.

The direction of the south jetty and the character of the shore protection was modified in 1883. The north jetty, from Salisbury Beach, is to be 4,000 feet long, approximately, and the south jetty, from Plum Island, is to be 2,400 feet, approximately.

Both are 15 feet wide on top, which is in a plane 12 feet above mean low water. The two jetties have slopes of 1 on 2 on the sea side and of 1 on 1 on the harbor side.

A map showing the location of the jetties is published in the Annual Report of the Chief of Engineers for 1885. Their form and dimensions are shown in the report for 1881. The location and details of construction of the dike are given in the report for 1883. The estimated cost of the improvement was $375,000.

The total appropriations to date are $297,500.

The amount expended to June 30, 1894, was $269,723.84.

On June 30, 1894, the condition of the improvement was as follows: The north jetty was 2,705 feet long, fully completed; the south jetty was completed for 1,077 feet, and partly completed for an additional distance of 223 feet, and its shore end was strengthened by a sand catch; the dike was completed so far as was prudent for its safety; it was 817 feet long, 5½ feet high above mean low water, except that near its center a weir had been left open, 150 feet long, its sill 2 feet above mean low water.

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The act of August 17, 1894, appropriated $20,000 for this improvement, and on August 23, 1894, it was recommended that the available funds be expended in continuing the full section of the south jetty; this was approved August 25, 1894, and on September 4, 1894, an advertisement was issued inviting proposals for this work.

The bids received were opened October 4, 1894, and an abstract of them will be found in the annexed table.

On October 16, 1894, a contract was entered into with the Rockport Granite Company, to deposit in the south jetty 15,000 tons of rubblestone.

Operations under this contract were commenced in the latter part of May, 1895, and as but 973 tons of rubblestone were deposited during the fiscal year, the works of improvement at the date of this report are in practically the same condition as on June 30, 1894.

The annual survey of the bar was made in May, 1895, and by comparison with the survey of 1894 it is found that the channel over the bar has swung farther to the southward. The depth on the bar and the outside contours are not materially altered.

To complete the improvement an appropriation of $77,500 will be required, all of which could be expended to advantage during the fiscal year ending June 30, 1897, in the extension of both jetties to their full projected lengths.

The advantages to be derived from the completion of the project are the deepening and widening of the channel across the bar, thereby affording a harbor of refuge on the inside of Salisbury Beach and giving easy access at high tide to the wharves at Newburyport for vessels drawing 17 feet, approximately.

This work is located in the collection district of Newburyport, Mass., of which Newburyport is the port of entry. The nearest light-house is on Plum Island, at the entrance of the harbor.

The accompanying commercial statistics for the fiscal year have been furnished by the collector of customs for Newburyport, Mass.

The dates and amounts of appropriations for this work are as follows:

Act of—		Act of—	
June 14, 1880	$50,000	September 19, 1890	$25,000
March 3, 1881	40,000	July 13, 1892	20,000
August 2, 1882	40,000	August 17, 1894	20,000
July 5, 1884	40,000		
August 5, 1886	37,500	Total	297,500
August 11, 1888	25,000		

Money statement.

July 1, 1894, balance unexpended		$7,776.16
Amount appropriated by act of August 17, 1894		20,000.00
		27,776.16
June 30, 1895, amount expended during fiscal year		7,571.52
July 1, 1895, balance unexpended		20,204.64
July 1, 1895, outstanding liabilities	$1,346.79	
July 1, 1895, amount covered by uncompleted contracts	17,253.21	
		18,600.00
July 1, 1895, balance available		1,604.64
Amount (estimated) required for completion of existing project		77,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		77,500.00

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Abstract of proposals for the delivery of rubblestone in the south jetty at Newburyport, Mass., opened October 4, 1894, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Name and address of bidder.	Price bid for stone per ton of 2,000 pounds.	Total tons can be delivered at price.
1	Joseph H. White, Boston, Mass	$1.39	* 12,949
2	George Willett Andrews, Biddeford, Me	1.33	13,533
3	Rockport Granite Co., Rockport, Mass.*	1.23	14,634
4	Pigeon Hill Granite Co., Rockport, Mass	1.27	14,173
5	Hughes Bros. & Bangs, Syracuse, N. Y	1.53	11,764

* Lowest bid.

The contract was awarded to the Rockport Granite Company, with the approval of the Chief of Engineers.

COMMERCIAL STATISTICS.

Amount of revenue collected, 1893, $918.01; 1894, ——; 1895, $423.15.

Shipping.	1893.		1894.		1895.	
	No.	Tons.	No.	Tons.	No.	Tons.
Entrances:						
Foreign	2	146	7	889	4	368
Clearances:						
Foreign	13	2,362	13	.....	8	1,306
Domestic	1	399	.....	.....	.....	.....

Imported.	1893.	1894.	1895.
Coal ..... tons	.....	1,554	643
Lumber ..... feet	34,260	.....	.....
Laths ..... number	98,600	.....	.....
Miscellaneous	115	.....	.....

Vessels of 200 to 500 tons burden, mostly of the larger class, and drawing from 10 to 14 feet, frequent the harbor.

A large quantity of coal is annually landed at this port from coastwise vessels, aggregating in number 250, the arrivals and clearances of which are not recorded, and statistics can not be given.

B 2.

IMPROVEMENT OF MERRIMAC RIVER, MASSACHUSETTS.

The mouth of the Merrimac River is 15 miles northwest from Cape Ann, Massachusetts. Tide water extends up it a distance of 19 miles, or to the foot of the "Upper Falls," 1½ miles above Haverhill, Mass.

Seven incorporated cities and the largest mills in New England are directly interested in this improvement.

Before improvement the channel was narrow and crooked, and much obstructed by ledges, bowlders, and shoals.

At mean low water vessels drawing not to exceed 7 feet could enter the river and proceed to South Amesbury, 9 miles from the mouth.

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The sea bar at the mouth of the river has been improved under specific appropriations for the improvement of Newburyport Harbor, while many sunken rocks and wrecks of piers and vessels lying inside the bar have been removed by general appropriations for the improvement of the river.

The object of the improvement is to widen, straighten, and deepen the natural channel of the river from the bar to the head of tide water.

The rise or fall of the tide at the mouth is 7.7 feet; at Haverhill Bridge, 4 feet.

No plan of the river above Newburyport has been published in the reports of the Chief of Engineers.

The project originally adopted in 1870 proposed to remove obstructions from the Upper and Lower Mitchells Falls, and to remove the Gangway Rock and the "Boilers" in Newburyport Harbor.

The cost was estimated to be $69,025.

The project was modified in 1874 so as to include the removal of rocks in and near the draw of the bridge at Deer Island, 2 miles above Newburyport, and at Rocks Bridge, and at Little Curriers Shoal, East Haverhill, so that the channel should have the following depths at ordinary high-water stages of the river: From the mouth to Deer Island Bridge, 5 miles, 16½ feet; thence to Haverhill Bridge, 12½ miles, 12 feet; thence to the foot of Mitchells Falls, Hazeltine Rapids, 1½ miles, 10 feet; thence through Mitchells Falls to the head of the Upper Falls, 2½ miles, not less than 4½ feet, when the mill water at Lawrence is running.

This revised project was estimated to cost $147,000.

The total appropriations to date are $242,366.72.

The expenditures to June 30, 1894, were $237,055.

The excess of expenditure over the estimate is due to the removal of rocks and other obstructions that were unknown and removal not contemplated when the estimate was made, and by the expense of necessary surveys and examinations not provided for in the estimate.

On June 30, 1894, the project for the improvement of the river was completed.

The act of August 17, 1894, provided as follows:

> The Secretary of War is directed out of the appropriation on hand to make a resurvey of said river with a view of obtaining a depth up to Haverhill equal to that over the bar at Newburyport.

Work on this survey was commenced in December, 1894, and at the date of this report is well advanced toward completion.

To extend the improvement so that the same depth of water as is now obtained through Mitchells Falls can be carried to Lawrence (a distance of 5 miles from the head of the falls) was in 1882 estimated to cost, for dredging through Gages Shoal and Andover Bar and removing bowlders and ledges, $11,000.

This work is located in the collection district of Newburyport, Mass., of which Newburyport is the nearest port of entry. The nearest light-houses are the Plum Island lights and the Newburyport Upper Harbor lights.

Commercial statistics are included in statement for Newburyport Harbor.

No increase of the tonnage of the river is apparent since the improvement was commenced, and no new lines of water transportation have been established.

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The dates and amounts of appropriations for this work are as follows:

Act of—		Act of—	
May 23, 1828	$32,100.00	June 18, 1878	$10,000.00
April 2, 1830	3,506.72	March 3, 1879	5,000.00
March 2, 1831	16,000.00	June 14, 1880	12,000.00
March 2, 1833	4,900.08	March 3, 1881	9,000.00
June 28, 1834	3,860.00	August 2, 1882	9,000.00
July 11, 1870	25,000.00	July 5, 1884	3,500.00
March 3, 1871	25,000.00	September 19, 1890	10,000.00
June 10, 1872	25,000.00	July 13, 1892	1,500.00
March 3, 1873	25,000.00		
June 23, 1874	10,000.00	Total	242,366.72
March 3, 1875	12,000.00		

Appropriations made since 1870 have been expended on the approved project of that date and its modifications.

Money statement.

July 1, 1894, balance unexpended	$5,311.72
June 30, 1895, amount expended during fiscal year	2,942.55
July 1, 1895, balance unexpended	2,369.17
July 1, 1895, outstanding liabilities	611.25
July 1, 1895, balance available	1,757.92

B 3.

IMPROVEMENT OF POWOW RIVER, MASSACHUSETTS.

Powow River is a tributary of the Merrimac River, which it joins from the north about 3½ miles above Newburyport.

The tide enters the river a distance of about 9,600 feet, following the channel, or to a dam just above the town of Amesbury, Mass.

The present channel is narrow, exceedingly crooked, and is not navigable at low water. The mean range of the tide at the mouth of the river is 6.7 feet.

The project for the improvement of the river was proposed January 24, 1885. It was based on the survey provided for in the act of July 5, 1884.

This project proposed to make a channel 9,600 feet long, 60 feet wide on the bottom, and 12 feet deep at mean high water, at an estimated cost of $77,000.

Four appropriations have been made for this improvement, viz: By the act of August 11, 1888, which appropriated $3,000 for dredging, provided that this sum shall not be expended until the towns of Amesbury and Salisbury, or either of them, shall have caused such a draw to be placed in the present bridge over said river as may be approved by the Secretary of War; by the act of September 19, 1890, $5,000, with a similar proviso; by act of July 13, 1892, $4,000, and by the act of August 17, 1894, $15,000; total, $27,000.

On April 10, 1889, the Secretary of War approved the plan of the proposed bridge. On May 11, 1892, the chairman of the selectmen of the town of Amesbury, Mass., stated that the bridge over the Powow River had been reconstructed in accordance with the approved plans.

On August 23, 1894, it was recommended that the available funds be expended in making a cut the whole length of the proposed channel, 25 feet wide, of full projected depth. This was approved August 25,

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1894, and on September 4, 1894, an advertisement was issued inviting proposals for this work.

The bids received were opened October 4, 1894, and an abstract of them will be found in the annexed table.

On October 15, 1894, a contract was entered into with Mr. Augustus R. Wright, of Portland, Me., to dredge 64,000 cubic yards from this river.

No operations were in progress under this contract during the fiscal year, and at the date of this report the original condition of the river is unaltered.

To complete this improvement will require an appropriation of $50,000, all of which could be expended during the fiscal year ending June 30, 1897.

This work is located in the collection district of Newburyport, Mass., of which Newburyport is the nearest port of entry. The nearest light-houses are the Newburyport Upper Harbor lights.

No increase in the tonnage of the river is apparent, and no new lines of water transportation have been established.

Commercial statistics are included in the statement for Newburyport Harbor.

Money statement.

July 1, 1894, balance unexpended	$12,000.00
Amount appropriated by act of August 17, 1894	15,000.00
	27,000.00
June 30, 1895, amount expended during fiscal year	35.55
July 1, 1895, balance unexpended	26,964.45
July 1, 1895, amount covered by uncompleted contracts	24,960.00
July 1, 1895, balance available	2,004.45
Amount (estimated) required for completion of existing project	50,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

Abstract of proposals for dredging in Powow River, Massachusetts, opened October 4, 1894, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Name and address of bidder.	Price bid for dredging, per cubic yard.	Total yards can be removed at price.
		Cents.	
1	Rittenhouse R. Moore, Mobile, Ala	44	56,818
2	Augustus R. Wright, Portland, Me.*	39	64,102
3	Columbian Dredging Co., East Boston, Mass	44½	56,179

* Lowest bid.

The contract was awarded to Mr. Augustus R. Wright, with the approval of the Chief of Engineers.

B 4.

IMPROVEMENT OF IPSWICH RIVER, MASSACHUSETTS.

Ipswich River empties into Plum Island Sound 9 miles south of Newburyport, Mass., and at the same distance west of Cape Ann. The head of navigation is 3 miles above the mouth.

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The entrance to Plum Island Sound is 7 miles east of the mouth of the river. Six feet depth at mean low water can be carried over the bar at the entrance to the sound, and between the bar and the mouth of the river there is a good anchorage, with from 3 to 5 fathoms of water.

Before improvement the channel of the river from its mouth to Barras Turn, a distance of 2 miles, was at least 60 feet wide and 4 feet deep at mean low water. From Barras Turn to the town wharves, a distance of 1 mile, the channel was narrow and crooked, and had at some places but 1½ feet depth at mean low water. The rise or fall of the tide is 8.4 feet.

The original project for improvement was submitted December 6, 1875. It proposed a channel 60 feet wide and 4 feet deep at mean low water from Barras Turn to the town wharves, at an estimated cost of $25,000.

On November 5, 1883, the project was divided into three partial projects:

1. The removal of the ledges at Heards Point and opposite Nabbys Point to a depth of 2 feet at mean low water, to open a navigable channel of that depth, at a cost of $15,900.

2. To dredge the shoals at Labor in Vain and The Shoals so as to open a channel 4 feet deep at mean low water and 60 feet wide, at a cost of $2,200.

3. To straighten the channel by making a cut across Barras Turn and to build a jetty to close the old channel, at a cost of $6,900.

In the Annual Report of 1887 it was recommended that the general project be modified by limiting the present improvement to opening a channel 60 feet wide and 4 feet deep through The Shoals and Labor in Vain, and extending it to the deep hole opposite the town wharves.

A chart showing this limited project was published in the Report of the Chief of Engineers for 1887.

The amount which has been appropriated for this work to date is $7,500.

The amount expended to June 30, 1894, was $2,637.59.

On June 30, 1894, the improved channel was completed as proposed at Labor in Vain; and at The Shoals it was 40 feet wide of full depth. Operations were in progress under a contract with Mr. Edgar P. Lovering, of South Boston, Mass. Work under this contract was continued until completed early in August, 1894; 7,266 cubic yards were removed from the river by this contract, and the partial project of 1887 was thereby completed.

To complete the original project would require an appropriation of $17,500, but it is believed that the present condition of the improvement will meet any reasonable demands of the existing commerce.

Ipswich River is in the collection district of Newburyport, Mass. The nearest light-house is the Ipswich Light on Castle Neck, about 1½ miles southeast from the mouth of the river.

Commercial statistics are included in the statement for Newburyport Harbor.

No increase in the tonnage of the river is apparent, and no new lines of water transportation have been established.

The dates and amounts of appropriations for this work are:

Act of—	
August 5, 1886	$2,500
August 11, 1888	2,500
July 13, 1892	2,500
Total	7,500

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Money statement.

July 1, 1894, balance unexpended	$4,862.41
July 30, 1895, amount expended during fiscal year	2,980.32
July 1, 1895, balance unexpended	1,882.09

B 5.

IMPROVEMENT OF ESSEX RIVER, MASSACHUSETTS.

Essex River winds between marshy banks for 3½ miles from the head of navigation, at the village of Essex, to its mouth, which forms a harbor of refuge for light-draft vessels, about 3 miles to the southeastward of the entrance to Ipswich River, Massachusetts.

The channel of the river is crooked and obstructed by sand bars and bowlders.

The project for its improvement was submitted May 15, 1891. It proposed to widen and deepen the upper 12,000 feet of the natural channel of the river, so that 4 feet at mean low water could be carried to the head of navigation in a channel 60 feet wide at a cost, as estimated, of $25,000.

Two appropriations have been made for this work, viz:

Act of—	
July 13, 1892	$5,000
August 17, 1894	5,000
Total	10,000

On August 23, 1894, it was recommended that the available funds be expended in excavating a channel 25 feet wide with the projected depth to the head of navigation. This was approved August 25, 1894; and on September 4, 1894, an advertisement was issued inviting proposals for this work.

The bids received were opened on October 4, 1894, and an abstract of them will be found in the annexed table.

On October 15, 1894, a contract was entered into with the Columbian Dredging Company, of Boston, Mass., to dredge 47,000 cubic yards from the river.

Operations were commenced under this contract immediately; suspended on account of the freezing of the river on November 15, 1894; resumed in June, 1895; and as during the year but 12,736 yards have been dredged, no appreciable benefit to navigation has resulted and the condition of the river at the date of this report is essentially as it was originally.

To complete the improvement will require an appropriation of $15,000, all of which could be expended to advantage during the fiscal year ending June 30, 1897.

Essex River is in the collection district of Gloucester, Mass., of which Gloucester is the port of entry. The nearest light-house is Annisquam Light, 2 miles east of the mouth of the river.

Commercial statistics are included in the statement for Gloucester Harbor, Massachusetts.

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Money statement.

July 1, 1894, balance unexpended		$5,000.00
Amount appropriated by act of August 17, 1894		5,000.00
		10,000.00
June 30, 1895, amount expended during fiscal year		1,069.19
July 1, 1895, balance unexpended		8,930.81
July 1, 1895, outstanding liabilities	$1,700.39	
July 1, 1895, amount covered by uncompleted contracts	6,510.16	
		8,210.55
July 1, 1895, balance available		720.26
Amount (estimated) required for completion of existing project		15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		15,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals for dredging in Essex River, Massachusetts, opened October 4, 1894, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Bidder.	Price bid for dredging per cubic yard.	Total yards can be removed at price.
		Cents.	
1	Eastern Dredging Co., Portland, Me.	32	28,125
2	Augustus B. Martin, Boston, Mass.	29½	30,509
3	Columbian Dredging Co., East Boston, Mass.*	19	47,367

* Lowest bid.

The contract was awarded to the Columbian Dredging Company, with the approval of the Chief of Engineers.

B 6.

HARBOR OF REFUGE, SANDY BAY, CAPE ANN, MASSACHUSETTS.

Sandy Bay is situated at the northeastern extremity of the promontory of Cape Ann, which forms the northern limit of Massachusetts Bay. Its shore lines form a little less than a right angle, and their directions are nearly north and south and east and west. The rocky island of Straitsmouth forms the eastern extremity of one shore line, and the steep headland of Andrews Point the northern end of the other. Following the line of the proposed breakwater the bay is 2¾ miles wide, and has a depth of 2 miles, approximately.

The bay on the land side is perfectly protected by steep, high hills, but it fronts the northeast and is open to the full force of the violent northerly and easterly gales of this coast.

The great seas of the ocean are broken, however, in a degree, by the sunken rocky ledges called Averys Ledge, the Dry and Little Salvages, the Flat Ground, and Abners Ledge, which are directly at the mouth of the bay. Inside these entrance ledges the bay is entirely unobstructed and has an average depth of 50 feet at mean low water.

A plan of the bay showing the proposed breakwater was published in the Annual Report of the Chief of Engineers for 1892, page 564.

The original project for improvement was submitted in 1884. It proposed a continuous breakwater 9,000 feet long, divided into two branches.

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One starts at Averys Ledge and runs in a direction a little west of north to Abners Ledge, a distance of 3,600 feet; the other extends 5,420 feet from Abners Ledge in a northwesterly direction and terminates at the 84-foot contour off Andrews Point.

The axis of the proposed breakwater is approximately at the inner edge of the ledges, at the entrance of the bay, and about 1 mile inside the Salvages and Flat Ground, which receive the first shock of easterly storm waves.

The southern entrance to the proposed harbor lies between Straitsmouth Island and Averys Ledge, and is to be 1,800 feet wide and at least 30 feet deep. The northern entrance near Andrews Point is 2,700 feet wide and 80 feet deep. They are so located with reference to each other that vessels can enter and leave the harbor with any wind.

The harbor formed by the breakwater covers an anchorage of 1,377 acres, in which the depth exceeds 24 feet at mean low water.

The original project proposed to build the substructure of the breakwater to the level of 22 feet below mean low water of a mound of rubblestone, 40 feet wide on top.

On March 2, 1892, the project was modified to include the entire breakwater by a report of the special board of engineers constituted for that purpose.

This project was approved March 17, 1892, and it proposes to construct the entire breakwater of rubblestone with the following section: On the sea side, from the bottom to 15 feet below mean low water, a slope of 1 on 1½; thence to mean low water, 1 on 3; thence to 18 feet above mean low water, 1 on 1; the width on the crest, 20 feet, and the rear slope, 1 on $\frac{7}{10}\frac{3}{0}$ to mean low water; thence to the bottom, 1 on 1.

The axis of the eastern branch of the breakwater is indicated by an iron spindle on Averys Ledge when in range with the south light-house on Thatchers Island. Cross ranges are established by iron pipes let into the rocks on Dry and Little Salvages, which mark points at intervals of 100 feet from the spindle (initial point) on Averys Ledge. The axis of the north branch is cross range 3640.

The estimated cost of the improvement is $5,000,000, to which must be added $2,500,000 for buoyage, lighting, and defense of the harbor.

These estimates are based upon consecutive annual appropriations of not less than 10 per cent of the original estimates of cost. Should operations be suspended at any time from want of funds, or annual appropriations be reduced to small sums for a series of years, the expense for the final construction will be proportionally increased.

The total appropriations to date are $750,000.

The expenditures, not including outstanding liabilities, to June 30, 1894, were $558,295.46.

On June 30, 1894, 671,776 tons of stone had been deposited in the breakwater, of which 661,828 tons were small stone (less than 4 tons weight) deposited below mean low water, and 9,948 tons large stone (averaging 6 tons weight) deposited above low water. The breakwater had been completed between cross ranges 3040 and 3540, brought to the grade of mean low water between ranges 2940 and 3040, and in addition the remainder of the distance between range 140 and 4740 is to the grade 22 feet below mean low water.

Operations were in progress under a contract with the Rockport and Pigeon Hill granite companies, and during the fiscal year 2,933 tons of small stone and 3,500 tons of large stone were placed in the breakwater, completing the contract satisfactorily in August, 1894.

The act of August 17, 1894, appropriated $150,000 for this work, and on August 23, 1894, it was recommended that the available funds

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be expended in constructing the substructure of the breakwater. This was approved August 25, 1894, and on September 4, 1894, an advertisement was issued inviting proposals for this work.

The bids received were opened October 4, 1894, and an abstract of them will be found in the annexed table.

On October 15, 1894, a contract was entered into with the Cape Ann Granite Company to deposit in the substructure of the breakwater 240,000 tons of small stone.

Operations were commenced under this contract in November, 1894, and during the fiscal year 5,313 tons of stone were deposited.

At the date of this report a total of 683,522 tons of stone have been deposited in the breakwater, of which 13,448 tons are large stone, and the balance, 670,074 tons, small stone.

The breakwater between cross ranges 140 and 4740 is at a grade not more than 22 feet below mean low water, and between ranges 3040 and 3640 it is completed. The completed portion of the breakwater is in good order, although some slight settling of the southern half is apparent.

To complete the project will cost $4,250,000.

During the fiscal year ending June 30, 1897, $500,000 could be expended to advantage.

The prospective benefits to commerce and navigation by the construction of this harbor of refuge are increased safety to life and property, and a consequent reduction in freight and insurance.

Sandy Bay is situated in the collection district of Gloucester, Mass., of which Gloucester is the port of entry. The nearest light-house is Straitsmouth Light, at the southern entrance of the bay.

The accompanying commercial statistics for the fiscal year ending June 30, 1895, have been furnished by Mr. Charles S. Rogers, of Rockport, Mass.

The dates and amounts of the appropriations for this work are as follows:

Act of—		Act of—	
July 5, 1884	$100,000	July 13, 1892	$150,000
August 5, 1886	100,000	August 17, 1894	150,000
August 11, 1888	100,000		
September 19, 1890	150,000	Total	750,000

Money statement.

July 1, 1894, balance unexpended		$41,704.54
Amount appropriated by act of August 17, 1894		150,000.00
		191,704.54
June 30, 1895, amount expended during fiscal year		35,786.32
July 1, 1895, balance unexpended		155,918.22
July 1, 1895, outstanding liabilities	$2,534.10	
July 1, 1895, amount covered by uncompleted contracts	140,108.13	
		142,642.23
July 1, 1895, balance available		13,275.99
Amount (estimated) required for completion of existing project		4,250,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		500,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

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Abstract of proposals for furnishing rubblestone in the breakwater at Sandy Bay, Massachusetts, opened October 4, 1894, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Name and address of bidder.	Price bid for stone per ton of 2,000 pounds.	Total tons can be delivered at price.
		Cents.	
1	Cape Ann Granite Co., Boston, Mass.*	59 1/10	251,256
2	Pigeon Hill Granite Co., Rockport, Mass	69	217,391
3	George Willett Andrews, Biddeford, Me	81	185,185
4	Hughes Bros. & Bangs, Syracuse, N. Y	77	194,805
5	Rockport Granite Co., Rockport, Mass	61	245,901

*Lowest bid.

The contract was awarded to the Cape Ann Granite Company, with the approval of the Chief of Engineers.

COMMERCIAL STATISTICS.

Articles.	1893.	1894.	1895.
Shipped:			
Stone.....tons..	170,000	271,000	300,000
Received:			
Coal.....tons..	8,126	8,900	9,000
Wood.....cords..	490	200	600
Lumber.....feet..	250,000	325,000	575,000
Fish.....pounds..	2,340,000	2,900,000	2,850,000
Mackerel.....barrels..	.....	900	700
Fish sounds.....pounds..	.....	260,000	275,000
Lobsters.....barrels..	600	900	700
Cod oil.....gallons..	7,200	9,000	9,000
Medicine oil.....do....	4,700	4,500	4,000
Salt.....hogsheads..	1,000	600	525

B 7.

IMPROVEMENT OF HARBOR AT GLOUCESTER, MASSACHUSETTS.

This is the most important harbor between Boston and Portland, and is the principal resort for all New England fishing vessels. It is situated at the southeastern extremity of Cape Ann, 20 miles northeast from Boston. It is easily entered when the dangerous storms of this coast occur, and provides a secure, ample shelter for all classes of vessels, except from south winds, and from these a moderate extent of protected anchorage is afforded in the inner harbor.

It contains in the outer roadstead, the inner harbor, and in the channel connecting them sufficient deep water for the most liberal demands of commerce, but the inner harbor and channel are obstructed by bowlders, ledges, and shoals dangerous and inconvenient to shipping, and the outer harbor or roadstead is open to the action of all southerly winds.

A plan of the harbor was published in the Annual Report of the Chief of Engineers for 1887, page 506.

The first project formed for improvement was submitted January 20, 1871, and was based on the survey provided for by the act of July 11, 1870. (Report of Chief of Engineers, 1871, p. 869.) This project proposed the removal of certain bowlders from the inner harbor at a cost, as estimated, of $10,606.20, and the construction of a breakwater from

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Eastern Point over Dog Bar to Round Rock Shoal, at an estimated cost of $494,148.65.

On November 10, 1884, Maj. C. W. Raymond, Corps of Engineers, by order of the special board of engineers that was considering the subject of the Sandy Bay breakwater, submitted a project for two breakwaters at the entrance of Gloucester Harbor, one to cost $752,000 on essentially the same site as that proposed in 1871, and a supplementary one through Normans Woe Rock to cost $607,000.

This project and estimate are published in the Chief of Engineers' Report for 1885, page 534.

On January 20, 1885, it was recommended, in accordance with act of July 5, 1884, that a survey of the inner harbor and of the reef off Muscle Point be made, and that Babsons Ledge be removed to 21 feet at mean low water. (Report of Chief of Engineers, 1885, p. 541.) In the annual report for this harbor for 1887 a general project for its improvement was submitted, based on the survey provided for by the act approved August 5, 1886. (Chief of Engineers' Report, 1887, p. 500.) This project proposed to remove from the inner harbor 101½ cubic yards of rock known to exist, and to dredge 216,000 cubic yards, scow measurement, at an estimated cost of $65,000, and to construct the breakwater recommended in the project of 1884, that extends from Eastern Point to Round Rock Shoal, at an estimated cost of $752,000.

The total appropriations to date are $120,000.

The expenditures to June 30, 1894, were $59,643.13.

The condition of the improvement on June 30, 1894, was as follows:

Clam Rock had been reduced from 1 foot to 9⅓ feet at mean low water; Pinnacle Rock from 8½ to 16½ feet, mean low water; rock off Pew's Wharf from 2 to 5 feet, mean low water; rocks off J. Friend's Wharf from 13 to 17 feet, mean low water. All of the above rocks were reduced to the level of the surrounding bottom. Babsons Ledge had been reduced from 11 to 14 feet, mean low water. All the proposed dredging had been done.

No work had been done on the breakwater. Operations were in progress under a contract with Messrs. Townsend & Johnston, of Somers Point, N. J., to remove 549 cubic yards of ledge, which were uncovered by the dredging. Work under this contract was satisfactorily completed July 31, 1894.

The act of August 17, 1894, appropriated $40,000 for this improvement, and on August 23, 1894, it was recommended that the available funds be expended in commencing the substructure (to the grade of mean low water) of the breakwater at Eastern Point. This was approved August 25, 1894.

On September 4, 1894, an advertisement was issued inviting proposals for this work, and the bids received were opened October 4, 1894. An abstract of them will be found in the annexed table.

On October 16, 1894, a contract was entered into with Rockport Granite Company to deposit 57,000 tons of rubblestone in the breakwater.

Operations under this contract were commenced in November, 1894, and during the fiscal year 35,497 tons of rubblestone were deposited in the breakwater, essentially completing 400 feet of its substructure.

At the date of this report the project for the improvement of the harbor, with the exception of the breakwater, is completed.

To complete the improvement will require an appropriation of $712,000, of which $200,000 could be expended to advantage during the fiscal year ending June 30, 1897.

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The prospective advantages to commerce by the completion of the improvement are a more safe anchorage for vessels seeking protection from southerly gales.

Gloucester Harbor is in the collection district of Gloucester, Mass., of which Gloucester is the port of entry. The nearest light-houses are Ten Pound Light, in the harbor, and Eastern Point Light, at its entrance.

The accompanying commercial statistics for the fiscal year have been furnished by the collector of customs at Gloucester, Mass.

The dates and amounts of the appropriations for this work are as follows:

Act of—		Act of—	
June 10, 1872	$10,000	July 13, 1892	$40,000
August 5, 1886	5,000	August 17, 1894	40,000
August 11, 1888	10,000		
September 19, 1890	15,000	Total	120,000

Money statement.

July 1, 1894, balance unexpended		$20,356.87
Amount appropriated by act of August 17, 1894		40,000.00
		60,356.87
June 30, 1895, amount expended during fiscal year		29,587.19
July 1, 1895, balance unexpended		30,769.68
July 1, 1895, outstanding liabilities	$7,416.94	
July 1, 1895, amount covered by uncompleted contracts	18,707.61	
		26,124.55
July 1, 1895, balance available		4,645.13

Amount (estimated) required for completion of existing project 712,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897 ..... 200,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for the delivery of rubblestone in breakwater at Gloucester, Mass., opened October 4, 1894, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Name and address of bidder.	Price bid per ton of 2,000 pounds.	Total tons can be delivered at price bid.
1	Pigeon Hill Granite Co., Rockport, Mass	$0.94	38,297
2	Cape Ann Granite Co., Boston, Mass	.89	40,449
3	Joseph H. White, Boston, Mass	1.09	33,027
4	Seth Perkins and J. E. White, Boston, Mass	.97	37,113
5	Rockport Granite Co., Rockport, Mass.*	.87	41,379
6	George Willett Andrews, Biddeford, Me	1.07	33,644
7	Hughes Bros. & Bangs, Syracuse, N. Y	1.42	25,352
8	Lanesville Granite Co., Rockport, Mass	.99½	36,180

* Lowest bid.

The contract was awarded to the Rockport Granite Company, with the approval of the Chief of Engineers.

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COMMERCIAL STATISTICS.

Amount of revenue collected, 1893, $9,083; 1894, $4,204; 1895, $8,660.

Shipping.	1893.		1894.		1895.	
	No.	Tons.	No.	Tons.	No.	Tons.
Entrances:						
Foreign	153	22,135	153	22,140	118	26,907
Domestic	9	1,490	29	3,522	32	3,500
Clearances:						
Foreign	145	18,021	143	18,169	104	8,233
Domestic	63	9,734	69	12,243	48	7,650

Articles.	1893.	1894.	1895.
	Tons.	*Tons.*	*Tons.*
Imported:			
Coal	* 30,000	52,000	.....
Iron	.....	200	.....
Salt	16,000	26,595	27,000
Lumber	† 288,000	100	† 397,000
Miscellaneous	500	2,500	3,000
Exported:			
Salt	.....	.....	250

* From coastwise ports. † Feet.

All classes of vessels frequent the harbor. Greatest draft, 22 feet. Total number of vessels boarded, 6,192.

B 8.

IMPROVEMENT OF HARBOR AT MANCHESTER, MASSACHUSETTS.

Manchester Harbor is situated about 5½ miles northeastward from the entrance of Salem Harbor, Massachusetts.

A chart of the harbor was published in the Annual Report of the Chief of Engineers for 1888, Part I, page 466.

The outer sheltered roadstead contains approximately 300 acres, with 5 fathoms of water.

The entrance channel from the roadstead to Proctors Point is everywhere at least 100 feet wide and 6½ feet deep at mean low water, and is unobstructed.

At the Narrows, distant 1,400 feet inside of Proctors Point, the depth in the channel was reduced to 1½ feet at mean low water; thence to the town wharves, a farther distance of 2,500 feet, no low-water channel originally existed. Near the town wharves the channel is crossed by the Boston and Maine Railroad (eastern division) on a bridge which has a draw opening 28 feet wide.

The original project for the improvement of this harbor was submitted November 28, 1887. It was based on a survey provided for in the river and harbor act of August 5, 1886. It proposed to dredge a channel 60 feet wide, 4,000 feet long, and 4 feet deep at mean low water from Proctors Point to the town wharves, at an estimated cost of $14,300.

The total appropriations for this improvement to date have been:

By the act of—	
August 11, 1888	$2,500
September 19, 1890	5,000
July 13, 1892	6,800
Total	14,300

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The expenditures to June 30, 1894, were $14,139.29, and the improvement was essentially completed. The channel was 60 feet wide, 4 feet deep, 4,000 feet long; opposite the town wharf it was 80 feet wide.

No operations were in progress during the fiscal year, and at the date of this report the improvement is in the same condition as on June 30, 1894.

Manchester Harbor is in the collection district of Gloucester, Mass., of which Gloucester is the port of entry. The nearest light-house is on Bakers Island, 2½ miles from Proctors Point

The existing commerce is nominal, and commercial statistics are included in the statement for Gloucester Harbor, Massachusetts.

Money statement.

July 1, 1894, balance unexpended	$660.71
July 1, 1895, balance unexpended	660.71

B 9.

IMPROVEMENT OF HARBOR AT SALEM, MASSACHUSETTS.

Salem Harbor is 12 miles to the northward of Boston, Mass. Fort Pickering Light marks its entrance between Winter Island on the west and Naugus Head on the east. The harbor is 1,750 feet wide at its entrance and 5,500 feet long between the 12-foot contours of opposite shores. It contains a well-sheltered, entirely unobstructed anchorage of about 110 acres, of a greater depth than 18 feet mean low water. In front of the city are extensive flats, which make long wharves necessary to reach deep water. The principal wharves of the city are located on South River, a small stream which formerly drained a tidal basin on the southwestern side of the city. This basin is now practically filled up by city improvements. The river is 3,000 feet long to the head of navigation at South or Lafayette Street Bridge. It is crossed by a highway bridge about one-fourth of a mile below the head of navigation, with a draw opening 31½ feet wide. The width of the river varies from 300 feet at its mouth to 150 feet at the head of navigation.

Originally the greatest depth of continuous low-water channel was 0.8 foot.

The original project for the improvement of the harbor was submitted December 16, 1872. It was proposed to dredge a channel 1,730 feet long, 300 feet wide, 8 feet deep at mean low water, at an estimated cost of $32,000. This project was essentially completed 1873–1875.

The present project for the improvement of the harbor was submitted December 2, 1889. It was based on a survey provided for in the act of August 11, 1888. It proposed as follows:

To clean out the channel of approach to South River to the original dimensions as dredged in 1873–1875, viz, 300 feet wide at the entrance and 150 feet wide off Derby Wharf Light, 8 feet deep at mean low water; to extend this channel with the same depth, gradually reducing the width to 100 feet to near the inner end of Derby Wharf, and from this point to the head of navigation to excavate a channel 50 feet wide and 6 feet deep at mean low water.

The total length of channel to be improved was 5,100 feet, approximately, and its excavation would require the removal of 85,000 cubic yards of material, at an estimated cost of $28,000.

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The total appropriations to date have been $53,000.

The expenditures to June 30, 1894, were $49,361.23.

On June 30, 1894, the project for the improvement of the harbor was completed.

The act of August 17, 1894, provided that "so much of the appropriation heretofore made as may be necessary shall be used in making a survey of Salem Harbor, with a view to widening the harbor channel to the mouth of South River to the width of 500 feet and giving a depth of at least 10 feet at mean low water, and from the mouth of said river to Derby Wharf, beginning with a width of 300 feet and gradually narrowing, so that there shall be at said wharf a width of not less than 160 feet, and a depth from said mouth to said wharf of not less than 10 feet at mean low water, and with a view of dredging the 'Middle Ground,' so called, between 'Haste Ledge' and 'Aqua Vitæ,' so as to give a depth of 25 feet at mean low water."

This survey was completed during the fiscal year, and on April 18, 1895, a report based on it was submitted, accompanied by a chart of the area surveyed.

Salem Harbor, including South River, Massachusetts, is in the collection district of Salem, Mass., of which Salem is the port of entry. The nearest light-house is Derby Wharf Light, Salem Harbor, Massachusetts.

The accompanying commercial statistics for the fiscal year ending June 30, 1895, have been furnished by the collector of customs at Salem, Mass.

The dates and amounts of the appropriations for this improvement are as follows:

Act of—	
March 3, 1873	$15,000
June 23, 1874	10,000
September 19, 1890	14,000
July 13, 1892	14,000
Total	53,000

Money statement.

July 1, 1894, balance unexpended	$12,761.21
June 30, 1895, amount expended during fiscal year	12,113.37
July 1, 1895, balance unexpended	647.84

COMMERCIAL STATISTICS.

Amount of revenue collected, 1893, $2,384.85; 1894, $2,171.18; 1895, $1,986.63.

Shipping.	1893.		1894.		1895.	
	No.	Tons.	No.	Tons.	No.	Tons.
Entrances:						
Foreign	74	11,536	80	11,334	65	6,853
Domestic	2	148	13	2,308	674	285,186
Clearances:						
Foreign	.....	6,820	55	10,915	25	2,458
Domestic	.....	8,303	58	8,867	.....	.....

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Imported.	1893.	1894.	1895.
Bricks.....number..	30,000	10,000	15,000
Clay.....tons..	405	60	.....
Coal.....do....	356,824	403,104	401,601
Firewood and bark.....cords..	752	733	484
Laths.....number..	1,774,000	822,200	540,000
Lime and cement.....barrels..	29,993	7,621	27,990
Lumber.....feet .	3,805,944	4,720,280	7,528,756
Piling.....do....	46,500	17,492	.....
Powder.....cases..	80	861	93
Railroad ties.....number..	7,926	5,800	.....
Sand.....tons..	5,904	6,194	4,405
Shingles.....number..	2,628,000	2,014,000	4,900,000
Stone.....tons.	6,849	3,512	1,520
Merchandise.....do....	.....	.....	520

Miscellaneous for 1894: Potatoes, 445 bushels; salt, 2,880 bushels; hay, 137 tons; water pipe, 24 pieces; gas pipe, 243 tons.

Miscellaneous for 1895: Barrels, 2,600; dynamite, 630 cases; eggs, 30 dozen; grease, 675 barrels; herring, 965 barrels; iron pipe, 300 pieces; lobsters, 85 cases; potatoes, 2,005 bushels; salmon, 18 barrels; wax, 270 pounds.

Vessels of all descriptions drawing from 10 to 18 feet frequent the harbor.

B 10.

IMPROVEMENT OF HARBOR AT LYNN, MASSACHUSETTS.

Lynn Harbor is situated 9 miles northeast from Boston. It is approximately 1 by 2 miles in extent, of which the greater part is dry at low tide.

It is protected on the north and west by the mainland, on the east by Nahant Beach, and its entrance, 2 miles wide, into Massachusetts Bay, is on the south side.

A plan of the harbor, showing the projected improvement, was published in the Annual Report of the Chief of Engineers for 1884, Part I, page 532.

Before improvement three narrow and crooked channels of approach to the wharves existed, in each of which there was about 6 feet depth at mean low water. The mean rise or fall of the tide is 9.3 feet.

The western channel leads to the Point of Pines and the mouth of the Saugus River. The main ship channel is entered between White and Lobster rocks, and connects about 3,600 feet northward with the Black Rock Channel, which is the most eastern, near Nahant Beach.

The project for the improvement was adopted in 1884. It provides for the excavation of a channel 200 feet wide and 10 feet deep at mean low water, from a point near and east of the White Rocks, to deep water opposite Little Nahant, a distance of 3,610 feet. This is called the outer improved channel, and is merely a rectification and deepening of the main ship channel. The combined main ship channel and Black Rock Channel are sufficient for the purposes of commerce for the next 2,500 feet. Then commences the inner improved channel, which is projected 6,450 feet long, 200 feet wide, and 10 feet deep at mean low water. It extends from deep water, opposite Sand Point, to the harbor commissioners' line, and follows very closely in direction the extension of the main ship and Black Rock channels.

On September 24, 1888, this project was modified. It was then proposed to extend the main ship channel 400 feet within the harbor line,

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and to excavate at its inner end a basin 500 by 300 feet in area, 10 feet deep at mean low water.

It is supposed that the inner channel will need to be dredged occasionally to maintain its width and depth, but a training wall about 6,000 feet long is proposed to aid in keeping the outer channel open, if experience shall show it to be necessary. This wall is to start from the shore at Little Nahant and is to cross Black Rock Channel. Its outer portion is to be parallel to the outer improved channel.

The cost of the original project was estimated to be $145,000. This estimate was revised in 1885, and then made $157,000, to provide for an increased amount of dredging found to be necessary during the progress of the work, to round off the junctions of the natural channel with the dredged channel, to provide flatter slopes to the sides of the cuts than was originally designed, and also to provide funds for necessary surveys during the progress of the work.

The modifications proposed September 24, 1888, were estimated to cost $25,000, which would make the total cost of the improvement $182,000.

The total appropriations for this work to date have been $108,500; of this amount $5,000 was expended on the western or Saugus River Channel as provided for in the act of July 13, 1892.

The amount expended to June 30, 1894, was $100,115.25.

On June 30, 1894, the outer channel and basin were completed; the inner channel was completed for 500 feet at its southerly end, the balance was 150 feet wide; the western or Saugus River Channel was 4,000 feet long, 150 feet wide, 8 feet deep at mean low water.

The act of August 17, 1894, appropriated $7,500 for this improvement.

On September 13, 1894, it was recommended that the available funds be expended in widening the inner channel to its full projected width. This was approved October 9, 1894.

On October 18, 1894, an advertisement was issued calling for proposals for this work. The bids received were opened November 19, 1894, and an abstract of them will be found in the annexed table.

On December 12, 1894, a contract was entered into with Mr. Augustus B. Martin, of Boston, Mass., to dredge 32,000 cubic yards from the inner channel.

Operations were commenced under this contract in June, 1895, and as during the fiscal year only 7,020 cubic yards were dredged, the condition of the improvement at the date of this report is essentially the same as on June 30, 1894.

To complete this improvement will require an appropriation of $73,500, of which $20,000 could be expended to advantage during the fiscal year ending June 30, 1897, in completing the proposed dredging.

Lynn is a port of entry in the collection district of Marblehead, Mass. The nearest light-house is Egg Rock (Nahant) Light, 3 miles distant.

The accompanying commercial statistics for the fiscal year ending June 30, 1895, have been furnished by the collector of customs at Marblehead, Mass.

The dates and amounts of appropriations for this work are as follows:

Act of—		Act of—	
August 2, 1882	$60,000	July 13, 1892	$10,000
August 5, 1886	6,000	August 17, 1894	7,500
August 11, 1888	10,000		
September 19, 1890	15.000	Total	108,500

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Money statement.

July 1, 1894, balance unexpended		$884.75
Amount appropriated by act of August 17, 1894		7,500.00
		8,384.75
June 30, 1895, amount expended during fiscal year		20.75
July 1, 1895, balance unexpended		8,364.00
July 1, 1895, outstanding liabilities	$1,689.27	
July 1, 1895, amount covered by uncompleted contracts	5,745.40	
		7,434.67
July 1, 1895, balance available		929 33
Amount (estimated) required for completion of existing project		73,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		20,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for dredging in Lynn Harbor, Massachusetts, opened November 19, 1894, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Name and address of bidder.	Price bid for dredging per cubic yard.	Total yards can be removed.
		Cents.	
1	Augustus B. Martin, Boston, Mass.*	23	32,608
2	Augustus R. Wright, Portland, Me.	28	26,785
3	Old Colony Dredging Co., Boston, Mass.	30	25,000

* Lowest bid.

The contract was awarded to Mr. Augustus B. Martin, with the approval of the Chief of Engineers.

COMMERCIAL STATISTICS.

Amount of revenue collected, 1893, $4,755.48; 1894, $3,124.31; 1895, $832.69.

Shipping.	1893.		1894.		1895.	
	No.	Tons.	No.	Tons.	No.	Tons.
Entrances:						
Foreign	48	4,030	27	2,519	43	4,127
Domestic	1,207	245,213	639	251,000	2,300	369,714
Clearances:						
Foreign	48	5,348	32	3,406	33	3,229
Domestic	1,207	245,213	639	251,006	2,306	370,255

Imported.	1893.	1894.	1895.
	Tons.	*Tons.*	*Tons.*
Coal	139,102	119,965	133,719
Iron	485	1,140	256
Lumber	*5,911,000	*3,523,000	*4,762,680
Merchandise	†2,540,000	‡11,500	‡33,700
Miscellaneous	21,000	‡14,590	§12,000

* Feet. † Shingles, laths, etc. ‡ Exported. § Lime, hay, bricks, sand, etc.

Lumber imported in 1895 includes foreign lumber.

Revenue greatly reduced owing to the admission of lumber free of duty, that being the chief article imported from foreign countries.

All classes of vessels frequent the harbor, drawing from 8 to 18 feet of water.

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B 11.

IMPROVEMENT OF HARBOR AT WINTHROP, MASSACHUSETTS.

This harbor is situated in the northeastern part of Boston Harbor, immediately westward of Winthrop Head.

A chart of the harbor was published in the Annual Report of the Chief of Engineers for the year 1888, Part I, page 470.

The harbor contains, approximately, 350 acres, all of which is dry at low tide except a short, narrow, crooked slough east of Snake Island. The mean range of the tide is 9.4 feet.

The nearest deep-water channel of Boston Harbor is known as the "Back" Channel, and it extends from Point Shirley to East Boston. It has from 9 to 16 feet depth at low tide. The town wharf is distant 3,900 feet from this "Back" Channel.

The original project for the improvement of this harbor was submitted November 28, 1887. It was based on the survey provided for in the act of August 5, 1886.

The project proposed to excavate a straight channel 3,900 feet long, 50 feet wide, and 6 feet deep at mean low water from the "Back" Channel to Rice's Wharf, at an estimated cost of $17,600.

For this improvement the following appropriations have been made:

By act of—	
August 11, 1888	$1,000
September 19, 1890	5,000
July 13, 1892	3,000
Total	9,000

The amount expended to June 30, 1894, was $8,983.21, and the proposed improvement had been completed.

No operations were in progress during the year, and at the date of this report the improved channel is in good order.

Winthrop Harbor is in the collection district of Boston, Mass., of which Boston is the port of entry. The nearest light-house is at Deer Island Point.

Commercial statistics are included in the statement for Boston Harbor

Money statement.

July 1, 1894, balance unexpended	$16.79
June 30, 1895, amount expended during fiscal year	9.38
July 1, 1895, balance unexpended	7.41

B 12.

IMPROVEMENT OF MYSTIC AND MALDEN RIVERS, MASSACHUSETTS.

These two rivers empty into the inner harbor of Boston, Mass.

The main river (Mystic) extends from the navy-yard to the town of Medford, a distance of about 4½ miles. Malden River is about 2 miles long, from the town of Malden to its junction with Mystic River, about 3 miles above the navy-yard.

Originally Mystic River had no navigable low-water channel. A project for its improvement was submitted May 9, 1891. It proposed to widen and deepen the natural channel of the river so that it should be 100 feet wide and 6 feet deep at mean low water to the first turn above Denning's Wharf, and thence to the head of navigation 4 feet

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deep, with the width gradually reduced to 50 feet at Craddock's Bridge. The cost of this improvement was estimated to be $25,000.

Originally in Malden River there was in a narrow and exceedingly crooked channel a navigable depth of barely 7 feet at mean high water. The rise of the tide is 9.8 feet. The original project for its improvement was proposed December 1, 1880. It contemplated the excavation of a channel 100 feet wide and 12 feet deep at mean high water up to the second drawbridge, with two cut-offs, one east of the island, near the junction of the Malden and Mystic rivers, and the other through the marsh land, about half a mile above, at a cost of $35,000.

This project was modified in 1882. It was then proposed to make the natural channel 100 feet wide and 12 feet deep at mean high water to the first bridge, and thence 75 feet wide to the second bridge, at an estimated cost of $40,000.

Ten thousand dollars were appropriated for this work by the act of 1882, and expended (1883–84) in making the channel from the mouth to the drawbridge in Malden, a distance of 1¼ miles, at least 50 feet wide (70 feet at turns), 12 feet deep at mean high water.

By the act of July 13, 1892, $10,000 were appropriated for the improvement of Mystic and Malden rivers.

On July 18, 1892, it was recommended that one-half of this amount be retained in the Treasury for the improvement of Malden River (when additional funds are available), and that the balance be expended in improving Mystic River as proposed from its mouth to Denning's Wharf.

On August 8, 1892, an advertisement was issued calling for proposals for this work. The lowest bid received (48 cents per cubic yard) was deemed excessive, and it was rejected.

The act of August 17, 1894, appropriated $10,000 for this improvement.

On August 23, 1894, it was recommended that the funds available for this improvement be expended in completing the project for Mystic River to a point about 1,500 feet above Denning's Wharf and in widening the improved channel of Malden River so that it would be not less than 70 feet wide to the first bridge in Malden.

This was approved August 25, 1894, and on September 4, 1894, an advertisement was issued inviting proposals for this work.

The bids received were opened October 4, 1894, and an abstract of them will be found in the annexed table.

On October 16, 1894, a contract was entered into with Mr. Charles H. Souther, of Boston, Mass., to dredge 75,000 cubic yards from the rivers. Operations were commenced under this contract in May, 1895, and at the date of this report 5,000 feet of the Malden River have been improved as proposed.

To complete the improvement of Mystic River would require an appropriation of $15,000, and of Malden River, $25,000; a total of $40,000; all of which could be expended to advantage during the fiscal year ending June 30, 1897.

Mystic and Malden rivers are in the collection district of Boston, Mass., of which Boston is the port of entry. The nearest light-house is on Long Island, Boston Harbor, Massachusetts.

The dates and amounts of appropriations for this work are as follows:

For Malden River, by act of August 2, 1882	$10,000
For Mystic and Malden rivers, by act of July 13, 1892	10,000
For Mystic and Malden rivers, by act of August 17, 1894	10,000
Total	30,000

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Commercial statistics are included in the statement for Boston Harbor, Massachusetts.

Money statement.

July 1, 1894, balance unexpended		$9,958.45
Amount appropriated by act of August 17, 1894		10,000.00
		19,958.45
June 30, 1895, amount expended during fiscal year		85.87
July 1, 1895, balance unexpended		19,872.58
July 1, 1895, outstanding liabilities	$2,742.01	
July 1, 1895, amount covered by uncompleted contracts	15,524.24	
		18,266.25
July 1, 1895, balance available		1,606.33
Amount (estimated) required for completion of existing project		40,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		40,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals for dredging in Mystic and Malden rivers, Massachusetts, opened October 4, 1894, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Name and address of bidder.	Price bid for dredging per cubic yard.	Total yards can be removed.
		Cents.	
1	Eastern Dredging Co., Portland, Me	33½	56,716
2	Rittenhouse R. Moore, Mobile, Ala	34	55,932
3	Augustus B. Martin, Boston, Mass	35	54,285
4	Charles H. Souther, Boston, Mass.*	23⅞	79,581

* Lowest bid.

The contract was awarded to Mr. Charles H. Souther, with the approval of the Chief of Engineers.

B 13.

IMPROVEMENT OF HARBOR AT BOSTON, MASSACHUSETTS.

Boston Harbor consists essentially of an inner and outer harbor, united by a deep waterway, and each accessible from the sea by a distinct channel, widening into a deep and spacious roadstead.

1. Inner harbor.—This harbor lies to the north and westward of Long Island, and has deep water and good anchorage in the President Roads, seaward of Lower Middle Bar, and also near the city, westward of Upper Middle Bar.

Four rivers discharge their waters into the basin, the Charles, Mystic, and Chelsea rivers from the north, and the Neponset from the south. The direct entrance from the sea is by Broad Sound.

2. Outer harbor.—This harbor lies to the southward of Long Island, and has a fine anchorage in Nantasket Roads, as well as in Hingham Bay, a well-sheltered harbor southeast of Paddocks Island. It connects with the inner harbor by the main ship channel through the "Narrows," and by secondary channels east and west of Long Island. It is reached from the sea by Nantasket Roads, which lie south of

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Georges and Great Brewster islands, and is marked at the sea entrance by Boston Light.

Weymouth and Weir rivers empty into the outer harbor.

Both the inner and outer harbors are subdivided into several minor harbors and contain many islands, which shelter the anchorages from winds and storm waves.

. The range of the tides at the navy-yard is 9.8 feet, and at the entrance to the outer harbor 9.4 feet. A sketch of the harbor was printed in the Annual Report of the Chief of Engineers for the year 1888, page 454.

The object of the improvement is, first, to preserve the harbor by protecting the islands and headlands; and second, to improve it by widening, deepening, and straightening the channels.

The works of preservation consist of sea walls, aprons, jetties, etc., which protect the shores of the islands and headlands, prevent additional wash into the channels, control the tidal scour, and preserve the full height of anchorage shelter for vessels in the roadsteads.

The works of improvement have been by dredging and blasting.

The total appropriations from 1825 to date have been $2,804,276.10.

The total expenditures to June 30, 1894 (not including outstanding liabilities), were $2,422,144.43.

WORKS OF PRESERVATION.

Point Allerton.—This headland at the southeasterly entrance of the harbor is protected by a granite sea wall 1,202 feet in length, completed in 1873. Its concrete foundation, for a distance of 1,005 feet, is protected by an apron and 8 short jetties of granite and rubblestone. No work was done on it during the fiscal year.

Its condition June 30, 1895, is as follows:

The wall is generally in good order, although some of its joints need repointing. The bluff protected by this wall is not fully covered from storm action, and the sea wall should be extended westward for a distance of at least 150 feet and the foundation of this extension should be protected with riprap.

This is estimated to cost $15,000.

Great Brewster Island.—This island is on the north side of the main ship channel, near the entrance. It is protected by a granite sea wall 2,840 feet long, which was completed in 1869.

No work was done on it during the fiscal year.

On June 30, 1895, the wall is in fair order, but some repointing is needed, for which funds are available.

Georges Island.—Its northern and eastern shores are protected by a granite sea wall 2,150 feet long. West of this wall is a riprap protection, extending for 450 feet, and south of it another 600 feet long. The sea wall and southern riprap were built about 1835. The western riprap was built in 1884–85.

No work was done on the wall or ripraps during the year, and they are in good order at the date of this report.

The unprotected western shore line of the island, in front of the Government buildings, has been considerably abraded, and it should be protected by a light sea wall, 1,400 feet long, at a cost of $35,000.

Lovells Island.—The western shore of this island is protected by a rubblestone apron 975 feet long, built in 1873, and repaired and extended in 1884; the northern shore is covered by a granite sea wall 750 feet long, built in 1843, and the eastern shore is protected by a granite sea wall 800 feet long, built in 1869, and repaired in 1879 and 1886, and by

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two rubblestone aprons, one between the northern and eastern sea walls, 1,440 feet long, and the other south of the east sea wall, 1,330 feet long.

No operations were in progress during the fiscal year.

The condition of the works on June 30, 1895, was as follows: The sea walls and the ripraps of the eastern shore were in good order, the western shore riprap was undermined in places and had fallen down, but it needed no immediate repairs.

Gallops Island.—The western, northern, and eastern shores of this island are protected by a granite sea wall 2,385 feet long, completed in 1892, and by a rubblestone apron, completed in 1884, 3,050 feet long, which also covers part of the foundation of the sea wall. No operations were in progress during the fiscal year, and at the date of this report the works are in good order.

Deer Island.—Three prominent bluffs of this island are protected by granite sea walls, originally built about 1827. The north head wall is 1,740 feet long, the middle head wall is 840 feet, and the south head wall is 380 feet long. In 1865 and 1869 these walls were partly rebuilt and in the weakest places were backed with concrete. They were all originally built dry, and from time to time have required repairs.

No operations were in progress during the year on these sea walls. At the date of this report the south head wall is in good order, but the north and middle head walls require repairs; 150 running feet of wall, 300 running feet of concrete and earth backing, and 400 running feet of the paving need resetting. These repairs are estimated to cost $6,000.

Long Island.—The north head of this island is protected by a granite sea wall 2,081¾ feet long, completed in 1874. Part of the foundation of the wall and the beach at both its ends are protected by a rubblestone apron, aggregating 1,675 feet in length. This apron was built in 1874 and extended in 1884 and 1892–93.

No operations were in progress during the fiscal year, and at the date of this report the wall and rubblestone apron are in good order, but the latter should be extended to the westward on the south shore of the island, a distance of at least 150 feet, at a cost of $3,000.

Rainsford Island.—The north head of this island is protected by a dry granite sea wall 1,500 feet long, originally built about 1840 and extensively repaired in 1884–85. No work was done during the fiscal year, and on June 30, 1895, the wall is in good order.

Castle Island.—The north and part of the east and west shores of this island are protected by a dry granite sea wall 3,300 feet long, built about 1835. A light riprap extends along the east shore 300 feet from the end of the wall; this was built in 1865. No work was done during the year ending June 30, 1895, and at that date the riprap was in good order. The sea wall needed repairs on the north face, a short distance west of the wharf, where the foundation has been undermined and the wall has settled. About 100 running feet of the wall has been thus injured, and this length of the wall needs taking down and rebuilding, at a cost of $1,000.

Governors Island.—The shore line of this island has never been protected. The east and south bluffs, however, should be covered by sea walls to prevent additional abrasion, not only to secure the sites of the batteries which occupy these bluffs, but also to prevent injury to the main ship channel.

The east bluff wall should be 500 feet long, and is estimated to cost $30,000; the south bluff wall should be 1,800 feet long, and will cost $50,000.

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WORKS OF IMPROVEMENT.

The main ship channel.—Before improvement it had a least width of 100 feet, and a least depth of 18 feet at mean low water. The original project for its improvement was submitted in 1867. It proposed to dredge the channel 23 feet deep at mean low water, 1,000 feet wide at the Upper and Lower middles, and 685 feet at the Narrows.

In 1870 the proposed width at the Narrows was reduced to 625 feet, and increased to 1,100 feet at the anchorage shoal in the inner harbor.

Under this project to June 30, 1894, the main channel was made 23 feet deep at mean low water, 1,100 feet wide west of the Upper Middle, 850 feet wide at the Upper Middle, 1,000 feet wide at the Lower Middle, and at least 625 feet wide elsewhere.

In effecting this improvement dredging or blasting was done at the following places:

At Nashs Rock Shoal, during the years 1876–1878, 365 cubic yards of ledge was removed.

At Kellys Rock and Shoal, during the years 1869–1879, 222 cubic yards of ledge was removed.

Tower, Corwin, and Channel rocks were removed during the years 1867–1875; they aggregated 608¾ cubic yards.

From the west end of Brewster Spit during the years 1874–1876, 1891, and 1892, 57,736 cubic yards of sand and gravel was dredged and 95½ cubic yards of ledge was removed.

At Lovells Island, from the southeast and southwest points, 267,294½ cubic yards was dredged during the years 1867–1877, and from the spur between these points 3,430 cubic yards was dredged in 1888.

At Castle Island Bar and Shoal, opposite the Lower Middle, during the years 1880–1883, 36,957 cubic yards was dredged and 20 tons of rock was removed.

At the Lower Middle, in 1874–1875, State and Palmyra rocks were removed; they aggregated 62 cubic yards. In 1887–1889, 71,892 cubic yards was dredged from this shoal and 375 cubic yards of ledge was removed.

At the Upper Middle, during the years 1870–1876, and 1880–1893, 626,452½ cubic yards was dredged and 229 cubic yards of ledge was removed.

At Anchorage Shoal, during the years 1879–1882, 155,243 cubic yards was dredged.

At Man-of-War Shoal, 85,917 cubic yards was dredged in the years 1878–1880.

At Mystic River Shoal, during the years 1879–1882, 144,826 cubic yards was dredged.

To complete this project the Upper Middle must be widened to 1,000 feet and the Point Allerton sea wall must be extended, sea walls built at Georges and Governors islands, and the Fort Point Channel completed, which works are estimated to cost $350,000.

A revised project for the improvement of the main channel was submitted August 11, 1892. It proposed, in accordance with the act of July 13, 1892, to widen and deepen the channel so that it should be 1,000 feet wide and 27 feet deep at mean low water. This revised project was estimated to cost $1,250,000.

Under this project, to June 30, 1894, the main ship channel had been dredged to make 27 feet deep at mean low water, 300 feet wide at the shoal east of Nashs Rock, 1,000 feet wide at the shoal west of Nashs

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Rock, 500 feet wide at the Centurion Shoal, and 700 feet wide in the Narrows. But the free use of this 27-foot channel was restricted by reason of the existence of ledges uncovered by the dredging.

During the fiscal year operations were in progress under a contract with Mr. Charles H. Souther and Mr. Augustus R. Wright to dredge 500,000 cubic yards from the main channel, in partial completion of this project.

This contract was completed April 30, 1895; under it 500,000 cubic yards were dredged and 31 cubic yards of bowlders, weighing over 6 tons each, were removed. In effecting this dredging, ledges aggregating about 9,000 cubic yards above the grade proposed were uncovered.

The act of August 17, 1894, appropriated $200,000 for the improvement of Boston Harbor, of which $10,000 may, in the discretion of the Secretary of War, be used in the further prosecution of the work in Nantasket Beach Channel.

On September 13, 1894, it was recommended that so much of the available funds as might be necessary be expended in removing the ledges uncovered by the dredging in the improved main channel. This was approved September 14, 1894, and on September 22, 1894, an advertisement was issued inviting proposals for this work. The bids received were opened on October 22, 1894, and an abstract of them will be found in the annexed table.

On November 27, 1894, a contract was entered into with Messrs. Townsend & Johnston, of Somers Point, N. J., to remove 8,772 cubic yards of ledge.

Operations under this contract were commenced in May, 1895, and as during the fiscal year but 300 cubic yards was removed, this portion of the channel is still unavailable for the free use of the increased depth obtained by dredging.

On February 8, 1895, it was recommended that the balance of the available funds be expended in continuation of the project, by dredging in the Narrows from the south shore of Lovells Island. This was approved February 12, 1895, and on February 25, 1895, proposals for this work were invited by public advertisement.

The bids received were opened April 2, 1895, and an abstract of them will be found in the annexed table.

On April 10, 1895, a contract was entered into with Mr. Charles H. Souther and Mr. Augustus R. Wright to dredge 150,000 cubic yards.

Operations were commenced under this contract in April, 1895, and during the fiscal year 80,048 cubic yards was dredged under it.

At the date of this report the main ship channel is 27 feet deep at mean low water, 1,000 feet wide from the entrance (near the outer light) to Bug Light. In the Narrows the channel is 800 feet wide to the passage between Georges and Gallops islands, and elsewhere remains as on June 30, 1894.

Operations are in progress under contracts to remove the ledges uncovered by the recent dredging and to still further widen the channel in The Narrows.

The total appropriations for this revised project of 1892 are—

By the act of—	
July 13, 1892	$265,000
August 17, 1894	190,000
Total	455,000

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The following tributary channels have been improved by dredging or blasting:

1. CHARLES RIVER.

This river empties into the inner harbor near the navy-yard at Charlestown.

Before improvement the natural channel had, so far up as Western avenue bridge, 4¾ miles from its mouth, 7 feet depth at mean low water, except in several places, covering about 1¼ miles in length below Brookline street bridge, where the depth varied from 4½ to 7 feet.

From Western avenue bridge to Arsenal street bridge (2½ miles) there was a depth of 4 feet at mean low water, and thence to the dam at the head of tide water (1¾ miles) a depth varying from 0 to 9½ feet above mean low water. The mean rise or fall of the tide is 10 feet. A sketch showing the river was published in the Annual Report of the Chief of Engineers for 1884, page 512.

The project for the improvement of this river consists in straightening, widening, and deepening the natural channel, so that it shall be from its mouth to Western avenue bridge 7 feet deep at mean low water and 200 feet wide; from Western avenue bridge to Market street bridge 6 feet deep at mean low water and 80 feet wide; thence to the dam at the head of tide water, 60 feet wide and 2 feet deep at mean low water.

The estimated cost of this improvement was originally $85,000. A revised estimate was submitted in 1881 of $125,000.

The total allotments from the appropriations for Boston Harbor for this work to date have been $77,500.

The expenditures to June 30, 1894, were $57,500.

No operations were in progress during the fiscal year, and the condition of the improvement on June 30, 1895, was as follows: The projected channel had been completed from the mouth of the river to Arsenal street bridge (7¼ miles); work was stopped at this point for the reason that the piers and draws of this bridge do not conform to the projected channel above it. In effecting this improvement 127,971 cubic yards was dredged during the years 1880–1884.

2. FORT POINT CHANNEL.

This channel is situated between the eastern shore of Boston proper on the one side and the reclaimed and improved flats of South Boston on the other side. It connects the tidal basin of South Bay, which has an area of 250 acres, with Boston inner harbor, is fast becoming the center of the city's most extensive shipping trade, and is the most important branch of the main ship channel. Fort Point Channel is 1¼ miles long.

Before improvement the least depth at mean low water was 12 feet at its entrance, and 17 feet above Congress street bridge.

That part of it which it is proposed to improve is spanned by bridges at Congress street, Mount Washington avenue, and at an intermediate point. The bridges have conveniently located draw openings, but the draw piers of the railroad bridge must be strengthened or reconstructed before the improvement can be extended past them, and the width of the draw increased to that of the other bridges above and below it.

The project for this improvement was submitted January 27, 1885. It proposed the excavation of a channel 175 feet wide and 23 feet deep at mean low water from the entrance to near Federal street bridge, a distance of 4,100 feet, and was estimated to cost $100,000, the railroad bridge to be reconstructed at the expense of the owners.

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By the act of August 5, 1886, $18,750 was allotted for the improvement of this channel from the appropriation for Boston Harbor.

The total expenditures to June 30, 1894, were $18,750.

No operations were in progress during the year, and the condition of the improvement June 30, 1895, is as follows: The channel is dredged as proposed from its entrance to Congress street bridge, a distance of 1,900 feet; 94,211 cubic yards was removed in effecting this improvement during the year 1887.

To complete the improvement, as proposed, to Federal street bridge will cost $60,000, and this sum could be expended to advantage during the fiscal year ending June 30, 1897, if the railroad draw shall have been properly reconstructed.

3. HINGHAM HARBOR.

See separate report.

4. NANTASKET BEACH CHANNEL.

This is a small channel along the east side of Hingham or Hull Basin. It leads to a wharf on the west side of the heel of Nantasket Beach, about 12 miles from Boston.

Before improvement it was approximately 100 feet wide and had a depth of at least 11 feet, except at the eastern end, 1,500 feet from the wharf, where the width was reduced to from 40 to 50 feet, and the depth to less than 8 feet. It was circuitous and obstructed by bowlders at the mouth of Weir River, and by a ledge near the wharf.

The project for improvement, adopted in 1880 and completed in 1881–1883, was to widen and deepen the channel from the mouth of Weir River to the steamboat wharf, so that it would be 100 feet wide and 9½ feet deep at mean low water, to remove a few bowlders at the mouth of Weir River, and to remove the ledge near the wharf.

In 1891, in accordance with the act of September 19, 1890, the channel was widened to 150 feet.

The total allotments for this work from the appropriations for Boston Harbor to date have been $41,067.80, of which $30,045.69 had been expended to June 30, 1894. On that date the improved channel was 150 feet wide and 12 feet deep at mean low water, except over the ledge at the steamboat wharf.

By the act of August 17, 1894, $10,000 was made available for this work.

On August 23, 1894, it was recommended that so much of the available funds as may be necessary be expended in removing the ledge near the steamboat wharf. This was approved August 29, 1894, and on September 8, 1894, proposals were invited by public advertisement for this work.

The bids received were opened October 8, 1894, and an abstract of them will be found in the annexed table.

On October 15, 1894, a contract was entered into with Messrs. Townsend & Johnston, of Somers Point, N. J., to remove 395 cubic yards of ledge.

Operations were commenced under this contract in October, 1894, and they were satisfactorily completed on November 30, 1894.

At the date of this report the channel is 150 feet wide and 12 feet deep at mean low water.

During the year $3,775.07 was expended on this improvement.

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5. CHANNEL BETWEEN NIXS MATE AND LONG ISLAND.

This is a channel through the bar which extends from the north head of Long Island to Nixs Mate Shoal. Previous to improvement there was 4½ feet depth of water on the bar at mean low tide.

The project for the improvement was adopted in 1883. It was to dredge a channel 200 feet wide, 12 feet deep at mean low water, and about 550 feet long. In 1887 it was recommended that the axis of the cut be shifted 30 degrees to the westward, and that it be widened to 300 feet and made 15 feet deep at mean low water. The original project was estimated to cost $9,000. The project of 1887 was estimated to cost $25,000 additional. No specific appropriation has been made for this work. The expenditure on it to June 30, 1894, from the appropriations for Boston Harbor, was $24,982.97. No operations were in progress during the fiscal year, and at the date of this report the channel is 300 feet wide, 15 feet deep at mean low water.

6. BROAD SOUND.

An obstruction called Barrel Rock, lying on the north side of the Broad Sound Channel, was removed in 1869. It contained 116 cubic yards.

7. JEFFREYS POINT CHANNEL.

This channel is an extension of the main ship channel from near Grand Junction Wharf (East Boston) toward Jeffreys Point.

A project for its improvement was submitted December 2, 1890, in accordance with the act of September 19, 1890. It was proposed to dredge a channel 400 feet wide from Grand Junction Wharf to just east of Simpson's Patent Dry Docks, and 18 feet deep at mean low water. Thence gradually narrowing the proposed channel to 250 feet, and decreasing the depth of water to 15 feet at mean low water to a junction with the same depth off Jeffreys Point. This was estimated to cost $50,000.

The total allotments for this work to date, from the appropriations for Boston Harbor, have been $50,000.

The expenditures to June 30, 1894, were $47,743.75, and the project was completed.

No operations were in progress during the year.

Recapitulation of amounts which could be expended to aavantage during the fiscal year ending June 30, 1897.

Extension of Point Allerton sea wall	$15,000
Sea wall for Georges Island	35,000
Sea walls for Governors Island	80,000
Widening main ship channel at Upper Middle	160,000
Completion of Fort Point Channel	60,000
Continuation of revised project for main channel	350,000
Total	700,000

The several works completed and projected for the improvement of this harbor are located in the collection district of Boston and Charlestown, Mass. Boston is the port of entry.

The accompanying commercial statistics for the fiscal year ending June 30, 1895, have been furnished by the collector of customs at Boston, Mass.

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The dates and amounts of the appropriations for this work are as follows:

Act of—		Act of—	
March 2, 1825	$52,972.56	March 2, 1867	$375,000.00
March 19, 1828	2,000.00	July 11, 1870	100,000.00
May 23, 1828	87,000.00	March 3, 1871	100,000.00
March 2, 1829	7,310.54	June 10, 1872	75,000.00
March 2, 1831	5,000.00	March 3, 1873	150,000.00
February 24, 1832	9,000.00	June 23, 1874	100,000.00
March 2, 1831	12,390.00	March 3, 1875	100,000.00
July 3, 1832	60,000.00	August 14, 1876	50,000.00
March 3, 1841	1,500.00	June 18, 1878	55,000.00
August 31, 1842	2,000.00	March 3, 1879	50,000.00
July 4, 1836	15,000.00	June 14, 1880	75,000.00
July 7, 1838	7,353.00	March 3, 1881	100,000.00
March 3, 1841	1,000.00	August 2, 1882	96,500.00
March 3, 1843	16,000.00	July 5, 1884	5,000.00
July 2, 1864	10,000.00	August 5, 1886	56,250.00
February 28, 1865	3,000.00	August 11, 1888	125,000.00
June 12, 1866	50,000.00	September 19, 1890	145,000.00
July 20, 1848	40,000.00	July 13, 1892	300,000.00
August 30, 1852	30,000.00	August 17, 1894	200,000.00
July 2, 1864	40,000.00		
February 28, 1865	20,000.00	Total	2,804,276.10
July 12, 1866	75,000.00		

Money statement.

July 1, 1894, balance unexpended		$182,131.67
Amount appropriated by act of August 17, 1894		200,000.00
		382,131.67
June 30, 1895, amount expended during fiscal year		141,512.70
July 1, 1895, balance unexpended		240,618.97
July 1, 1895, outstanding liabilities	$21,442.39	
July 1, 1895, amount covered by uncompleted contracts	164,848.93	
		186,291.32
July 1, 1895, balance available		54,327.65
Amount (estimated) required for completion of existing project		1,145,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		700,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for removal of ledge from Nantasket Beach Channel, Boston Harbor, Massachusetts, opened October 8, 1894, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Name and address of bidder.	Price bid for blasting per cubic yard.	Total.
1	Enoch Townsend and C. W. Johnston, Somers Point, N. J.*	$8.75	$3,456.25
2	Geo. Willett Andrews, Biddeford, Me.	11.62	4,589.90
3	Geo. W. Townsend, Boston, Mass.	14.43	5,699.85

* Lowest bid.

The contract was awarded to Messrs. Enoch Townsend and C. W. Johnston, with the approval of the Chief of Engineers.

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Abstract of proposals for removal of ledges from Boston Harbor, Massachusetts, opened October 22, 1894, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Name and address of bi der.	Price bid for removal of ledges per cubic yard.	Total.
1	Townsend & Johnston. Somers Point, N. J.*	$16.48	$144.562.56
2	P. Sanford Ross, Jersey City, N. J	18 00	157.896.00
3	Geo. Willett Andrews, Biddeford, Me	16.62	145.790 64

*Lowest bid.

The contract was awarded to Messrs. Townsend & Johnston, with the approval of the Chief of Engineers.

Abstract of proposals for dredging in the Narrows, Boston Harbor, Massachusetts, opened April 2 by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Name and address of bidder.	Price bid for—		Total yards can be removed at price bid.
		Dredging, per cubic yard.	Removal of bowlders over 6 tons weight.	
		Cents.		
1	Charles H. Souther and Augustus R. Wright, Boston, Mass.*	29	$12.50	155,555
2	C. W. Anthony, Fall River, Mass	41⅝	20.00	107,398
3	Emory R. Seward, Albany, N. Y	48½	20.00	92,783

*Lowest bid.

The contract was awarded to Messrs. Charles H. Souther and Augustus R. Wright with the approval of the Chief of Engineers.

COMMERCIAL STATISTICS.

Amount of revenue collected, 1893, $15,791,588.16; 1894, $8,981,449.98; 1895, $9,486,115.75.

Shipping.	1893.		1894.		1895.	
	No.	Tons.	No.	Tons.	No.	Tons.
Entrances, foreign	2,373	1,633,740	2,096	1,696,108	2,106	1,764,494
Clearances, foreign	2,231	1,330,165	2,032	1,432,167	1,942	1,423,257

	1893.	1894.	1895.
Importations:			
Merchandise	$79,357,654	$50,319,331	$66,822,576
Coin and bullion	29,207	450,750	6,469
Exportations:			
Foreign merchandise	865,265	1,131,114	469,978
Coin and bullion			9,200
Domestic merchandise	84,596,157	82,842,346	85,049,181
Coin and bullion	2,250,250	2,150,000	4,000

The number of coastwise arrivals, as published by the chamber of commerce for the year 1894, was 8.419

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B 14.

IMPROVEMENT OF WEYMOUTH RIVER, MASSACHUSETTS.

Weymouth (Fore) River, tributary to Hingham Bay, Boston Harbor, Massachusetts, is one of the most important water courses on the south coast of Massachusetts Bay. It is navigable at low water for vessels not exceeding 18 feet draft for 4 miles from its mouth, and for a farther distance of 3 miles, to the head of navigation, at least 3 feet depth was found at mean low water before its improvement.

The original project of improvement was submitted December 2, 1889; it was based on the survey provided for in the act of August 11, 1888, and proposed to improve the natural channel of the river by dredging, so that 6 feet depth at mean low water could be carried to the head of navigation, in a channel 100 feet wide near the wharves at Weymouth Landing; thence to Braintree Bridge, 80 feet wide, and above the bridge 50 feet wide, with increased width at each turn to facilitate the movement of vessels. The total length of channel to be improved was 7,000 feet, approximately, and the cost was estimated to be $40,000.

The total appropriations for this work to date have been $25,000.

The expenditures to June 30, 1894, were $10,038.64.

On June 30, 1894, the improved channel was 6 feet deep at mean low water, 40 feet wide to Braintree Bridge, and 25 feet wide thence to the head of navigation.

The act of August 17, 1894, appropriated $5,000 for this river, "of which $2,500 shall be used in the improvement of Weymouth (Back) River."

On August 23, 1894, it was recommended that the funds available ($12,461.36) for Weymouth (Fore) River be expended in continuation of the project by widening the improved channel so that it would be 60 feet wide to Braintree Bridge, and 50 feet wide above this bridge.

This was approved August 28, 1894, and on September 8, 1894, an advertisement was issued calling for proposals for this work. The bids received were opened October 8, 1894, and an abstract of them will be found in the annexed table.

On October 22, 1894, a contract was entered into with Messrs. Perkins & White, the lowest bidders, to dredge 37,000 cubic yards.

Operations were commenced under this contract December 1, 1894 (were suspended from December 29, 1894, to March 20, 1895), and during the fiscal year 18,528 cubic yards was dredged.

At the date of this report the improved channel is 60 feet wide to within 3,000 feet of Braintree Bridge, and above the bridge 25 feet wide.

The project for the improvement of Weymouth (Back) River, Massachusetts, was submitted February 7, 1891, and it proposed to dredge a channel through the outer bar 200 feet wide and 12 feet deep at mean low water, and to widen and deepen the natural channel of the river to the same dimensions to the wharf of the fertilizer company, at an estimated cost of $22,000.

The expenditure of the available funds ($2,500) would produce no appreciable benefit to commerce, and on March 23, 1895, it was recommended that they be retained in the Treasury until an additional appropriation is made.

The amount required to complete the improvement of Weymouth (Fore) River is $17,500; to complete Weymouth (Back) River, $19,500; total, $37,000.

Weymouth River is in the collection district of Boston, Mass., of which Boston is the port of entry. The nearest light-house is on Long Island, Boston Harbor, Massachusetts.

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Commercial statistics are included in the statement for Boston Harbor, Massachusetts.

The dates and amounts of the appropriations for this work are as follows:

By act of—	
September 19, 1890	$10,000
July 13, 1892	10,000
August 17, 1894	5,000
Total	25,000

Money statement.

July 1, 1894, balance unexpended		$9,961.36
Amount appropriated by act of August 17, 1894		5,000.00
		14,961.36
June 30, 1895, amount expended during fiscal year		5,709.77
July 1, 1895, balance unexpended		9,251.59
July 1, 1895, outstanding liabilities	$1,101.60	
July 1, 1895, amount covered by uncompleted contracts	5,356.88	
		6,458.48
July 1, 1895, balance available		2,793.11
Amount (estimated) required for completion of existing project		37,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		37,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893		

Abstract of proposals for dredging in Weymouth River, Massachusetts, opened October 8, 1894, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Name and address of bidder.	Price bid for dredging per cubic yard.	Total yards that can be removed.
		Cents.	
1	Augustus B. Martin, Boston, Mass	36	30,555
2	Seth Perkins and J. E. White, Boston, Mass.*	29	37,931
3	Eastern Dredging Co., Portland, Me	37½	29,333

* Lowest bid.

The contract was awarded to Messrs. Perkins & White, with the approval of the Chief of Engineers.

B 15.

IMPROVEMENT OF HARBOR AT HINGHAM, MASSACHUSETTS.

Hingham Harbor is situated in the southern part of Hingham or Hull Basin, which comprises all that part of Boston Lower Harbor south of Nantasket Roads.

A chart of the harbor was published in the Annual Report of the Chief of Engineers for 1888, Part I, page 456.

The harbor covers an area of 1 square mile, and has extensive mud flats bare at low tide.

The mean rise or fall of the tide is 9.4 feet.

The channel leading to Hingham, south of Ragged and Sailor islands, was, before improvement, very narrow and crooked, and obstructed by

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sunken rocks and shoals. Its least width was 30 feet and least depth 4 feet at mean low water.

The object of its improvement was to widen and deepen the natural channel from deep water, near the head of the harbor, to the steamboat wharf, a distance of 2,500 feet.

The original project of improvement was submitted December 23, 1874.

It provides for an improved channel on the east side of Sailor Island, past the west side of beacon to the Hingham Wharf, 100 feet wide and 8 feet deep at mean low water, at an estimated cost of $11,000.

This project was modified January 20, 1885, when it was proposed to deepen the improved channel to 10 feet at mean low water, and to remove a mid-channel ledge, lying between Chandler and Ragged islands, at an estimated cost of $18,750.

The total amount appropriated for this work to date is $29,000.

The expenditures to June 30, 1894, were $29,000, and the project for the improvement of the harbor was completed.

No operations were in progress during the fiscal year, and at the date of this report the improved channel is in good order.

Hingham Harbor is in the collection district of Boston, Mass. The nearest lighthouse is the Narrows Light, on the main ship channel in Boston Harbor, 5 miles distant.

The dates and amounts of the appropriations for this work are as follows:

Act of—	
March 5, 1886	$10,000
August 11, 1888	6,000
September 19, 1890	5,000
July 13, 1892	3,000
Total	29,000

Commercial statistics are included in the statement for Boston Harbor.

B 16.

IMPROVEMENT OF HARBOR AT SCITUATE, MASSACHUSETTS.

Scituate Harbor is on the west shore of Massachusetts Bay, 14 miles from either Boston or Plymouth light-houses, and just southwest of the direct sailing course of all ocean-going vessels entering Boston Harbor.

Before improvement the harbor had a low-water area of 57 acres, approximately, more than 6 acres of which had a depth of at least 3 feet at mean low water. It was entirely open to the action of east winds, and the entrance was obstructed by many sunken bowlders. The depth on the bar was about 2½ feet at mean low water. The mean rise or fall of the tide is 9.8 feet.

The plan of the harbor, showing the proposed improvement, was published in the Annual Report of the Chief of Engineers for 1881, Part I, page 522.

The object of the improvement is to create a harbor of refuge for vessels bound to Boston which are too far south of their course to clear the dangerous ledges near Minots light-house.

The project for the improvement, adopted in 1881, is to build two rubblestone breakwaters converging from opposite shores, and to

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dredge an anchorage basin with channels connecting with the sea and the town wharves.

The north breakwater, from Cedar Point, is to be 800 feet long, and the south breakwater, from the point of the first cliff, is to be 730 feet long. Both breakwaters are to be 20 feet wide on top and 4 feet above mean high water, except at their outer ends, which are to be built 6 feet higher, to serve as sites for entrance beacons. The anchorage basin is to be 30 acres in area, approximately. The entrance channel is to be 2,700 feet long and 300 feet average width.

The estimated amount of dredging (including the entrance channel) was 500,000 cubic yards, to give a depth of 15 feet in the entrance channel, 12 to 15 feet between the breakwaters, 12 feet immediately in rear of the south breakwater, and 10 feet for the anchorage basin; the channel leading to the town wharves is to be 3 feet deep, all at mean low water.

The estimated cost of the breakwaters was $100,000, and of the dredging $190,000, a total of $290,000.

The total amount appropriated for this work to date is $83,680.

The amount expended to June 30, 1894, was $73,635.79.

The condition of the improvement June 30, 1894, was as follows:

A portion of the beach between Cedar Point and the mainland was protected by a brush and stone bulkhead 450 feet long, in front of which was a stone apron 10 feet wide, 385 feet long.

All known bowlders obstructing the entrance of the harbor were removed.

The anchorage basin was 400 by 350 feet in area, 7 feet deep at mean low water.

The entrance channel was 1,600 feet long, 100 feet wide, and 5 feet deep at mean low water. The channel connecting the basin with the town wharves was 3 feet deep at mean low water and 100 feet wide, except at the upper end, where, for a distance of 75 feet, it averaged only 50 feet wide.

The north breakwater was 720 feet long, the south breakwater 300 feet long.

On August 25, 1894, it was recommended that the available funds be expended in extending the south breakwater.

Proposals for this work were invited by public advertisement dated September 8, 1894, and on October 8, 1894, the bids received were opened. An abstract of them will be found in the annexed table.

On October 22, 1894, a contract was entered into with the Pigeon Hill Granite Company to deposit 9,500 tons of rubblestone in the south jetty.

Operations were commenced under this contract in November, 1894, and during the fiscal year 3,823 tons of stone was deposited in the south breakwater. At the date of this report it is 450 feet long, and the north breakwater, the entrance channel, the anchorage basin, and the channel leading to the town wharves are in the same condition as on June 30, 1894.

To complete the improvement will require an appropriation of $207,500, of which $30,000 could be expended to advantage during the fiscal year ending June 30, 1897, in completing the south breakwater.

Scituate is in the collection district of Plymouth, Mass., of which the port of entry is Plymouth, Mass. The nearest light-house is Minots Light, about 5 miles distant.

The accompanying commercial statistics have been furnished by the collector of customs at Plymouth, Mass.

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The dates and amounts of the appropriations for this work are as follows:

Act of—		Act of—	
March 2, 1829	$180	August 11, 1888	$5,000
August 30, 1852	1,000	September 19, 1890	10,000
June 14, 1880	7,500	July 13, 1892	10,000
March 3, 1881	10,000	August 17, 1894	10,000
August 2, 1882	10,000		
July 5, 1884	10,000	Total	83,680
August 5, 1886	10,000		

Appropriations since 1880 have been expended in accordance with the present project.

Money statement.

July 1, 1894, balance unexpended		$44.21
Amount appropriated by act of August 17, 1894		10,000.00
		10,044.21
June 30, 1895, amount expended during fiscal year		2,856.48
July 1, 1895, balance unexpended		7,187.73
July 1, 1895, outstanding liabilities	$1,461.61	
July 1, 1895, amount covered by uncompleted contracts	5,279.61	
		6,741.22
July 1, 1895, balance available		446.51
Amount (estimated) required for completion of existing project		207,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		30,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals for rubble stone for Scituate Harbor, Massachusetts, opened October 8, 1894, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Name and address of bidder.	Price bid per ton of 2,000 pounds.	Total tons that can be delivered at price bid.
1	Rockport Granite Co., Rockport, Mass	$1.19	7,562
2	George Willett Andrews, Biddeford, Me	1.21½	7,407
3	Chas. T. Derry, Boston, Mass	1.45	6,206
4	Seth Perkins and J. E. White, Boston, Mass	1.67	5,389
5	Pigeon Hill Granite Co., Rockport, Mass.*	.93	9,677
6	Joseph H. White, Boston, Mass	1.17	7,692

*Lowest bid.

The contract was awarded to the Pigeon Hill Granite Company, with the approval of the Chief of Engineers.

COMMERCIAL STATISTICS.

Shipping.	1893.		1894.		1895.	
	No.	Tons.	No.	Tons.	No.	Tons.
Entrances:						
Foreign	2	205	2	.....	1	125
Domestic	22	3,080	35	.....	39	5,000
Clearances:						
Foreign	.....	.....	2	.....	1	.....
Domestic	.....	.....	35	.....	.....	.....

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Imported.	1893.	1894.	1895.
Coal ..... tons..	2,500	3,000	3,500
Lumber ..... feet..	1,000,000	1,800,000	1,100,000
Lime ..... barrels..	1,000	1,000	1,000
Brick ..... number..	150,000	300,000	.....
Shingles ..... do....	.....	3,000,000	2,500,000
Miscellaneous ..... barrels..	* 1,000	† 9,000	† 7,500

* Herring. † Irish moss exported.

Vessels of an average draft of 10½ feet frequent the harbor.

B 17.

IMPROVEMENT OF HARBOR AT PLYMOUTH, MASSACHUSETTS.

Plymouth Harbor is situated 30 miles south of Boston. Its outer anchorage, the "Cow Yard," is common to Plymouth, Kingston, and Duxbury, and is the only refuge for seagoing vessels from northeasterly gales when caught between Boston and Provincetown, a distance of about 75 miles, following the coast line. The entrance to this outer anchorage is direct, unobstructed, of ample width, and sufficiently deep for the wants of commerce. The anchorage is capacious, and has good "holding ground," but the extensive tidal basins inside of it give strong variable currents across it.

The inner or harbor proper is formed by Long Beach, a narrow, low sand spit 3 miles long, which extends generally parallel to the mainland and about 1 mile from it.

The harbor contains about 2,000 acres, almost all of which is dry at low tide. A few narrow, crooked channels traverse these flats. They join about the center of the harbor, opposite the town wharves, and form the main ship channel (150 feet wide, approximately, and 10 feet deep at mean low water), which runs directly behind the northern half of Long Beach to the outer anchorage.

The maintenance of this inner harbor and channel depends on the preservation of Long Beach.

A chart of the harbor was published in the Annual Report of the Chief of Engineers for the year 1888, Part I, page 460.

Before improvement about 6 inches depth of water could be carried to the town wharves at low tide.

Previous to 1875 the project was a general one, and had for its object the preservation of Long Beach. From the nature of the work it can at no time be considered completed, and small annual appropriations are necessary to repair any damages done by storms. The various devices employed for this purpose are described in the Annual Report of the Chief of Engineers for 1877.

The project for the improvement of the harbor was first adopted in 1875. It provided for dredging a channel from the town wharves to the main ship channel, 2,286 feet long, 100 feet wide, and 6 feet deep at mean low water. This project was modified in 1877 so as to include the dredging of a basin 866 feet long, 150 feet wide, and 8 feet deep directly in front of the town wharves.

In 1884 and 1885 it was proposed to deepen the channel and basin to 9 feet at mean low water and to make the channel 150 feet wide.

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The modified project of 1884 required the excavation of 81,000 cubic yards (scow measurement), and was originally estimated to cost $27,000. This estimate was revised in 1885, in accordance with the low prices then current for dredging, and the cost was then estimated to be $22,500.

From 1824 to date the amount appropriated for this harbor is $181,266.90, of which there had been expended to June 30, 1894:

For beach protection	$127,245.34
For dredging	50,514.89
Total	177,760.23

On June 30, 1894, the improved channel was 2,286 feet long, the basin was 866 feet long; both were 150 feet wide, 9 feet deep at mean low water. Long Beach was in good order.

No operations were in progress during the year.

At the date of this report Long Beach is in good order and the project for the improvement of the harbor is completed.

A small sum should always be available for the harbor to immediately repair any damage made to Long Beach by storms. These necessary repairs have averaged in the last twenty years $1,500.

Plymouth Harbor is in the collection district of Plymouth, Mass., of which Plymouth is the port of entry. The nearest light-houses are the Plymouth (Gurnet) Lights, about 5 miles from Plymouth, and Duxbury Pier Light, about 2 miles distant.

The accompanying commercial statistics for the fiscal year ending June 30, 1895, have been furnished by the collector of customs at Plymouth, Mass.

The dates and amounts of appropriations for this harbor are as follows:

Act of—		Act of—	
May 26, 1824	$20,000.00	March 3, 1873	$3,000.00
March 3, 1825	5,712.00	June 23, 1874	5,000.00
March 25, 1826	13,184.90	March 3, 1875	10,000.00
April 23, 1830	1,850.00	June 18, 1878	5,000.00
March 2, 1831	2,820.00	March 3, 1879	3,500.00
July 3, 1832	2,500.00	June 14, 1880	10,000.00
March 2, 1833	600.00	March 3, 1881	10,000.00
June 28, 1834	2,000.00	August 2, 1882	14,000.00
March 3, 1835	700.00	July 5, 1884	10,000.00
July 2, 1836	500.00	August 5, 1886	6,000.00
July 7, 1838	2,400.00	August 11, 1888	6,000.00
August 31, 1852	5,000.00	September 19, 1890	8,000.00
July 11, 1870	10,000.00	July 13, 1892	9,500.00
March 3, 1871	10,000.00	August 17, 1894	1,500.00
June 10, 1872	2,500.00	Total	181,266.90

Money statement.

July 1, 1894, balance unexpended	$2,017.59
Amount appropriated by act of August 17, 1894	1,500.00
	3,517.59
June 30, 1895, amount expended during fiscal year	10.92
July 1, 1895, balance unexpended	3,506.67
Amount (estimated) required for completion of existing project	1,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	1,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

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COMMERCIAL STATISTICS.

Amount of revenue collected, 1893, $47,330.06; 1894, $24,073.13; 1895, $6,947.39.

Shipping.	1893.		1894.		1895.	
	No.	Tons.	No.	Tons.	No.	Tons.
Entrances:						
Foreign	3	286	1	195	4	.....
Domestic	108	.....	95	.....	83	.....
Clearances:						
Foreign	8	1,721	5	1,074	5	.....

Imported.	1893.	1894.	1895.
	Tons.	*Tons.*	*Tons.*
Coal	19,094	24,285	22,663
Iron	650	1,512	1,598
Lumber	*2,085,000	*2,260,000	*2,600,000
Sand	140	.....	165
Miscellaneous	2,178	.....	.....

*Feet.

Coasting schooners of an average draft of 13 feet frequent the harbor.

B 18.

IMPROVEMENT OF HARBOR AT KINGSTON, MASSACHUSETTS.

Kingston Harbor is one of the three divisions which together constitute Plymouth inner harbor. North of it, at a distance of 3 miles, is Duxbury Harbor, and 4 miles south, Plymouth Harbor.

The wharf at which supplies are landed for the town of Kingston is about 2 miles south from the center of the town, and is known as the Plymouth Cordage Company's Wharf.

The object of the improvement is to obtain a channel of approach to this wharf.

The project for the improvement of the harbor was submitted May 25, 1891. It proposed to dredge a channel 4,000 feet long, 100 feet wide, 6 feet deep at mean low water, from deep water to the Cordage Company's Wharf, at an estimated cost of $10,000

The act approved July 13, 1892, appropriated $10,000 for this work.

The total expenditures to June 30, 1894, were $8,940.09, and on that date the project had been completed.

No operations were in progress during the fiscal year, and at the date of this report the improved channel is in good order.

Kingston is in the collection district of Plymouth, Mass., of which Plymouth is the port of entry. The nearest light-house is Duxbury Pier Light.

Commercial statistics are included in the statement for Plymouth Harbor.

Money statement.

July 1, 1894, balance unexpended	$1,059.91
July 1, 1895, balance unexpended	1,059.91

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B 19.

IMPROVEMENT OF HARBOR AT WELLFLEET, MASSACHUSETTS.

Wellfleet Harbor is situated on Cape Cod Bay, 12 miles southeast of Provincetown Harbor, Massachusetts.

A chart of the harbor was published in the Annual Report of the Chief of Engineers for the year 1888, Part I, page 478.

The harbor consists of an outer anchorage south of Smalleys Bar and an inner harbor north of said bar.

The outer harbor is sufficiently capacious, free from obstructions, and protected to meet the present demands of commerce; but the inner harbor, although capacious and perfectly protected, had no low-water navigable connection with the town wharves.

It was, in the original condition of the harbor, 4,200 feet from the 6-foot contour to the wharves, and not to exceed 6 inches draft could be carried to them at low water.

The original project for the improvement of this harbor was submitted November 3, 1871. It was based on the survey provided for in the act of January 31, 1871.

It proposed to dredge two channels, each 150 feet wide and 4 feet deep at mean low water, one 2,060 feet long to reach Central and Commercial wharves, and one 1,400 feet long to reach Mercantile Wharf. It was also proposed to remove 204 cubic yards of sunken rocks. The cost of this project was estimated to be $30,000.

On November 28, 1887, a revised project was submitted. It was based on the survey provided for in the act of August 5, 1886. It proposed to dredge a channel from the "Deep Hole" to the town wharves, 6 feet deep at mean low water, 100 feet wide, and 4,200 feet long, at an estimated cost of $24,000.

This estimate was revised in 1889, and then made $31,000.

The total appropriations for this harbor to date have been $16,000.

By act of—	
June 10, 1872	$5,000
August 11, 1888	7,000
September 19, 1890	4,000
Total	16,000

The total amount expended to June 30, 1894, was $11,350.37, and the condition of the improvement was as follows: Mayo, Bay, Lobster, and Lumpfish rocks had been removed, and a channel had been dredged from the "Deep Hole" to the town wharves, 2,500 feet long, 4 feet deep at mean low water, and 25 feet wide. Opposite the town wharves the channel was enlarged to 75 feet wide to facilitate the docking of vessels.

The act of September 19, 1890, appropriated $4,000 to continue this improvement. No appreciable benefit to commerce would result by the expenditure of this amount, and it is to be retained in the Treasury until additional funds are provided.

To complete the improvement will require an appropriation of $22,000, all of which could be expended to advantage during the fiscal year ending June 30, 1897.

The accompanying commercial statistics for the fiscal year ending June 30, 1895, have been furnished by the collector of customs at Barnstable, Mass.

Wellfleet is in the collection district of Barnstable, Mass., of which Barnstable is the port of entry. The nearest light-house is Mayo Beach Light.

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Money statement.

July 1, 1894, balance unexpended	$4,649.63
July 1, 1895, balance unexpended	4,649.63
Amount (estimated) required for completion of existing project	22,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	22,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Amount of revenue collected, 1893, $53; 1894, $53; 1895, ———.

Shipping.	1893.		1894.		1895.	
	No.	Tons.	No.	Tons.	No.	Tons.
Clearances, foreign	1	78	2	170	.....	.....

Imported.	1893.	1894.	1895.
	Tons.	*Tons.*	*Tons.*
Coal	1,000	1,500	1,200
Lumber	100	.....	.....
Merchandise	.....	250	.....
Miscellaneous	10	51	*20,000

*Bushels oysters.

Vessels drawing from 6 to 12 feet frequent the harbor.

B 20.

IMPROVEMENT OF HARBOR AT PROVINCETOWN, MASSACHUSETTS.

Provincetown Harbor is situated at the extremity of Cape Cod, about 40 miles southeast from Boston Light. It is one of the most valuable harbors of refuge on the Atlantic Coast. The entire commerce of New England and a very large local fishing interest are directly benefited by its maintenance, which depends entirely on the preservation of the sandy beaches which inclose it.

Since 1826 the project has been a general one, and provides for the preservation of the harbor by building dikes, bulkheads, and sand catches, and extensive planting of beach grass to repair or prevent storm damages to the beaches.

From the nature of the work it can at no time be considered completed.

A full history of the improvement will be found in the Annual Reports of the Chief of Engineers for the years 1876, 1879, and 1886. A special dike across House Point Island Flats, to be built contingently, was recommended in the Annual Report for 1886.

A plan of the harbor was published in the Annual Report of the Chief of Engineers for 1886.

The total appropriations for this harbor to date have been $154,418.44.

The amount expended to June 30, 1894, was $147,677.49.

The condition of the several works of preservation in this harbor on June 30, 1894, was as follows:

Long Point.—This long, narrow, low point forms the southeastern limit of the harbor. It was in good order, but to more fully protect

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the light-house lot at its easterly end the breakwater should be extended 100 feet farther to the northwest.

Abel Hill Dike.—This dike was built to prevent a rush of water from Lanceys Harbor over House Point Island Flats into the main harbor. The rapid wearing away of the southern sand spit that formed Lanceys Harbor had threatened to make a breach through the beach south of the dike. To guard against this, brush and wooden sand catches had been built on the outer beach, opposite the west end of the dike. The dike was in good order, but the sand catches needed minor repairs.

House Point Island Flats.—These flats remained essentially unaltered from the condition shown by the last survey, and, as stated in the Annual Report for 1887, it still appears unnecessary to commence the dike projected to be built across these flats.

Beach Point, High Head Dike, and Cove Section.—These works were all in good order.

During the fiscal year repairs were made to the bulkheads protecting Long Point, near the Wood End Light, and near Abel Hill Dike, and at the date of this report all the works of preservation in this harbor are in good order.

The nature of the works of preservation of the harbor requires a small sum to be always available for immediate repairs. Such necessary repairs have averaged $1,500 per annum.

The prospective benefit to commerce is the preservation of an important harbor of refuge.

The accompanying commercial statistics have been furnished by the collector of customs at Provincetown, Mass.

Provincetown is a port of entry in the collection district of Barnstable, Mass. The nearest light-houses are Wood End and Long Point lights.

The dates and amounts of the appropriations for this work are as follows:

Act of—		Act of—	
May 19, 1826	$3,500.00	March 3, 1875	$5,000.00
March 2, 1829	3,500.00	August 14, 1876	4,000.00
March 2, 1831	2,050.00	June 18, 1878	1,000.00
March 3, 1832	4,600.00	March 3, 1879	1,000.00
June 28, 1834	4,400.00	June 14, 1880	500.00
March 3, 1835	4,400.00	March 3, 1881	5,000.00
July 2, 1836	4,400.00	August 2, 1882	5,000.00
July 7, 1838	4,500.00	July 5, 1884	2,000.00
August 30, 1852	5,000.00	August 5, 1886	3,000.00
June 23, 1866	43,068.44	August 11, 1888	3,000.00
July 28, 1866	8,000.00	September 19, 1890	7,500.00
March 3, 1871	6,000.00	July 13, 1892	1,500.00
June 10, 1872	5,000.00	August 17, 1894	1,500.00
March 3, 1873	6,000.00		
June 23, 1874	6,000.00	Total	154,418.44

Money statement.

July 1, 1894, balance unexpended	$5,240.95
Amount appropriated by act of August 17, 1894	1,500.00
	6,740.95
June 30, 1895, amount expended during fiscal year	2,169.28
July 1, 1895, balance unexpended	4,571.67
Amount (estimated) required for completion of existing project	1,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	1,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

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COMMERCIAL STATISTICS.

Amount of revenue collected, 1893, $492.77; 1894, ——; 1895, $308.82.

Shipping.	1893.		1894.		1895.	
	No.	Tons.	No.	Tons.	No.	Tons.
Entrances:						
Foreign	56	8,781	29	4,353	15	1,664
Domestic	14	800	18	1,260	5	590
Clearances:						
Foreign	22	2,627	15	.....	16	1,532
Domestic	27	6,750	3	.....	3	494

Imported.	1893.	1894.	1895.
	Tons.	*Tons.*	*Tons.*
Coal	6,500	5,000	5,600
Iron	1,500	50	45
Flour	.....	.....	*3,000
Grain	.....	.....	600
Lumber	1,500	†1,500,000	†1,300,000
Salt	.....	675	.....
Wood	.....	‡250	‡300
Merchandise	.....	.....	2,550
Miscellaneous	3,800	3,160	.....

* Barrels. † Feet. ‡ Cords.

All classes and nationalities of vessels visit the harbor for shelter or with cargo.
Estimated value of vessels which entered the harbor during the year, $45,000,000.

B 21.

IMPROVEMENT OF HARBOR AT CHATHAM, MASSACHUSETTS.

Chatham Harbor is at the eastern end of Nantucket Sound, about 15 miles east of Hyannis, Mass. Its outer anchorage, known as Chatham Roads, is a capacious, deep, unobstructed harbor of refuge from northerly and easterly gales.

The inner harbor, locally known as "Stage" Harbor, is small but well landlocked. It is about one-half mile long, 500 to 600 feet wide, and has 8 to 12 feet depth at mean low water. Its entrance was originally obstructed by three bars, on which the depth at mean low water was not to exceed 4 feet. The mean rise or fall of the tide is 5 feet.

The project for the improvement of the inner harbor was submitted December 19, 1890, and was based on a survey made in October, 1890. It proposed to dredge a channel 6 feet deep at mean low water through the three obstructing bars, 100 feet wide at the inner bar, 150 feet wide at the middle bar, and 200 feet wide at the outer bar, at an estimated cost of $10,000.

But one appropriation has been made for the work, viz, by the act of September 19, 1890, $5,000.

The total expenditures to June 30, 1894, were $4,402.15.

On June 30, 1894, the improved channel through the middle and inner bars was 100 feet wide, 6 feet deep at mean low water. Nothing had been done on the outer bar. At least 5 feet draft could be carried into the harbor at mean low water.

No operations were in progress during the fiscal year, and at the date of this report the condition of the improvement is the same as on June 30, 1894.

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To complete the improvement would require an appropriation of $5,000, all of which could be expended during the fiscal year ending June 30, 1897.

Chatham Harbor is in the collection district of Barnstable, Mass., of which Barnstable is the port of entry. The nearest light-house is Hardings Beach Light.

The accompanying commercial statistics have been furnished by the collector of customs at Barnstable, Mass.

Money statement.

July 1, 1894, balance unexpended	$597.85
July 1, 1895, balance unexpended	597.85
Amount (estimated) required for completion of existing project	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS.

Shipping.	1893.		1894.		1895.	
	No.	Tons.	No.	Tons.	No.	Tons.
Entrances, domestic	.....	.....	125	1,517	.....	.....
Clearances, domestic	.....	.....	125	1,517	.....	.....

Imported.	1893.	1894.	1895.
	Tons.	*Tons.*	*Tons.*
Coal	2,000	1,200	1,500
Iron	5	.....	.....
Grain	1,000	.....	.....
Lumber	1,000	* 200,000	* 37,000
Miscellaneous	1,000	100	25

* Feet.

Vessels of all kinds drawing from 2 to 10 feet frequent the harbor for shelter or with cargo.

B 22.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

On July 11, 1894, the wreck of the schooner *Ocean Eagle* was reported to be an obstruction to navigation, and its removal recommended at an estimated expense of $1,500.

The wreck was sunk in 10 fathoms of water about 2½ miles southeast from Plum Island Light, Newburyport Harbor, Massachusetts.

Sealed proposals were invited for this work by an advertisement dated July 28, 1894. The bids received were opened August 28, 1894, and an abstract of them will be found in the annexed table.

On September 1, 1894, a contract was entered into with the lowest bidder, Mr. G. W. Townsend, of Boston, Mass., and the wreck was satisfactorily removed by the contractor by September 17, 1894, at a cost of $172.70.

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Abstract of proposals for removing wreck of schooner Ocean Eagle in Newburyport Harbor, Massachusetts, opened August 28, 1894, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Name and address of bidder.	Amount.
1	Edwin Canney, Rockport, Mass	$485.00
2	Duncan, Nickerson & Co., Boston, Mass	325.00
3	Townsend & Johnston, Somers Point, N. J	150.00
4	George W. Townsend, Boston, Mass.*	87.00
5	George Willett Andrews, Biddeford, Me	247.50

* Lowest bidder.

Contract awarded to George W. Townsend, with the approval of the Chief of Engineers.

B 23.

PRELIMINARY EXAMINATION OF MANCHESTER HARBOR, MASSACHUSETTS, FROM MOUTH OF THE RIVER BELOW THE POINT OF ROCKS, WITH A VIEW TO A CHANNEL 100 FEET WIDE AND 5 FEET DEEP, AND REMOVAL OF SAND BAR AT MOUTH OF RIVER AND REMOVAL OF SAND BAR AND ROCKS AT THE POINT OF ROCKS.

[Printed in House Ex. Doc. No. 49, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1894.

SIR: I have the honor to submit the accompanying copy of report, dated October 29, 1894, of Lieut.-Col. S. M. Mansfield, Corps of Engineers, giving result of preliminary examination of Manchester Harbor, Massachusetts, "from mouth of the river below the Point of Rocks, with a view to a channel 100 feet wide and 5 feet deep, and removal of sand bar at mouth of river and removal of sand bar and rocks at the Point of Rocks," provided for by river and harbor act of August 17, 1894.

Colonel Mansfield reports that the Government has recently improved the channel from the Point of Rocks to the town wharves, and that, for the reasons stated, he is of the opinion that the harbor is worthy of improvement to the extent of removing the obstructions at the mouth and at Point of Rocks and the dredging of the channel between them to 100 feet wide with 5 feet depth. I concur in the opinion of Colonel Mansfield.

The necessary survey may be made for $300.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF LIEUT. COL. S. M. MANSFIELD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., October 29, 1894.

GENERAL: In accordance with requirements of letter from your office of August 20, 1894, I have the honor to submit the following report upon the examination of Manchester Harbor, Massachusetts,

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from the mouth of the river below the Point of Rocks, with a view to a channel 100 feet wide and 5 feet deep, and removal of sand bar at mouth of river and removal of sand bar and rocks at the Point of Rocks.

The Government has improved the channel recently from the Point of Rocks to the town wharves, making it 60 feet wide and 4 feet deep at mean low water, and it has been of great benefit to the place. The shoal at the mouth of the river (entrance to the harbor) and the obstructions of sand or bowlders at Point of Rocks should be removed to make fully available the improvements already accomplished. Between the mouth and Point of Rocks a sharp bend in the channel increases the difficulties in this narrow passage, and it should be eased by widening it to 100 feet. Considerable increase of business has followed the improvements already made, and much more may be expected in the competition with the railroad in supplying the town with coal and building materials when the reasonable harbor facilities are developed.

For the reasons stated I am of the opinion that the harbor is worthy of improvement by the General Government to the extent of removing the obstructions at the mouth and at Point of Rocks, and the dredging of the channel between them to 100 feet wide with 5 feet depth.

A detail survey is necessary as a basis for a project and estimate cost of improvement, and may be made for $300.

Accompanying this report is a communication from the selectmen of Manchester, indorsed by a few of its prominent residents.

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

LETTER FROM CERTAIN OFFICIALS AND CITIZENS OF THE TOWN OF MANCHESTER MASS.

MANCHESTER, *September 3, 1894.*

DEAR SIR: We, the undersigned, selectmen, merchants, and residents of the town of Manchester, Essex County, Mass., desire to call your attention to the following facts preliminary to your survey in relation to the proposed further improvement of our harbor and the widening and deepening of the channel leading to the wharves therein:

First. The improvements made by the Government within the last few years in the present channel, which is now 60 feet in width and 4 feet deep at mean low water from Proctors Point to the town wharf, have been of great advantage to the town and to its commerce. Yachts' boats and boats of fishermen are now enabled to come up to the wharves for supplies, small steamers and steam yachts come up the channel for coal and water, and as the public water supply of Manchester is stated to be far better for steam boilers than any other water found on this coast, it is believed that if the channel is still further widened and deepened so that larger vessels can enter the harbor, the commerce of Manchester will be greatly increased.

Our town valuation has increased from $4,826,888 in 1886 to $7,276,252 in 1894. A marine railway has been built, upon which fishing vessels and yachts can haul out for repairs, and 34 yachts were hauled up last winter, a new industry having thus been created; while the consumption of coal has been increased from 2,800 tons in 1886 to 5,000 tons at the present time. A new coal wharf has been built, at which 3 steam yachts have their permanent coaling stations. The consumption of hay and other products has also been largely increased, and it is believed that the cost of these products to the consumers can be considerably reduced if greater facilities are provided for bringing them in by water than by rail.

Second. While the channel from the roadstead to Proctors Point is 100 feet wide and about 6½ feet deep, a bar has been formed at the mouth of the channel between Glass Head and Ram Island, with a depth of but 2½ to 3 feet at mean low water. This

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bar prevents the channel from washing itself clear, and in one or two other places there are obstructions in this channel which should be cleared away to a depth of at least 6½ feet. The last appropriation covered only the channel from Proctor's wharf to the town wharf, and it is not possible for vessels which can come up the inner channel to enter the outer channel at all tides until the bar and other obstructions above referred to are removed. There is a ledge off Proctors Point which narrows the channel at that point, and this should be cleared away.

Third. It is stated by some of our oldest inhabitants that the channel in our harbor was formerly 8 feet in depth. At present the inner channel is 4 feet in depth and the outer channel beyond Proctors Point about 6½ feet in depth. We believe that it would be a great benefit to have the inner channel dredged to a width of 150 feet clear and a depth of at least 6½ feet at low water, so that it may correspond with the outer channel, and request that this be done.

Fourth. The flats in the harbor have filled up greatly within the last few years, and we would respectfully suggest that they be dredged out as far as possible, so that there may be an anchorage for boats at all tides, and that the small-boat channel leading from the main channel to the boat landing may be further deepened and cleared to a reasonable extent. We desire to have the harbor improved as far as possible,

And remain, very respectfully, yours,

ALFRED S. JEWETT,
BENJAMIN S. BULLOCK,
HENRY T. BINGHAM,
Selectmen of Manchester.
T. JEFFERSON COOLIDGE, Jr.,
T. JEFFERSON COOLIDGE,
HENRY S. GREER,
JOHN H. HOLMES,
JNO. B. SCHOEFFEL,
ARTHUR AMORY,
Steamer *Turtle.*
GEO. PUTNAM.

Col. S. M. MANSFIELD,
U. S. Engineer Corps.

B 24.

PRELIMINARY EXAMINATION OF PLYMOUTH HARBOR, MASSACHUSETTS, WITH A VIEW TO THE REMOVAL OF THE OBSTRUCTIONS KNOWN AS "SPLITTING KNIFE" AND "MIDDLE GROUND," AND THE NORTH AND SOUTH SIDES OF THE EXCAVATED CHANNEL IN SAID HARBOR, WITH A VIEW TO DEEPENING AND IMPROVING THE SAME.

[Printed in House Ex. Doc. No. 50, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1894.

SIR: I have the honor to submit the accompanying copy of report of October 29, 1894, by Lieut. Col. S. M. Mansfield, Corps of Engineers, giving results of preliminary examination of Plymouth Harbor, Massachusetts, "with a view to the removal of the obstructions known as 'Splitting Knife' and 'Middle Ground,' and the north and south sides of the excavated channel in said harbor with a view to deepening and improving the same," as required by river and harbor act of August 17, 1894.

Work at Plymouth has been carried on for a number of years under appropriations by Congress, but, for the reasons stated, it is the opinion of Colonel Mansfield, in which I concur, that the harbor is worthy of additional improvement by the General Government to the extent of removing the "Middle Ground" obstructions and of the easterly end of "Splitting Knife" to ease the entrance to the dredged channel.

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The survey necessary for the preparation of project and estimates may be made for $300.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF LIEUT. COL. S. M. MANSFIELD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., October 29, 1894.

GENERAL: In accordance with the requirements of letter from your office of August 20, 1894, I have the honor to submit the following report upon the examination of Plymouth Harbor, with a view to the removal of the obstructions known as "Splitting Knife" and "Middle Ground," and the north and south sides of the excavated channel in said harbor with a view to deepening and improving the same.

The present condition of the harbor and dredged channel is only fairly satisfactory. The removal of the Middle Ground, which is a serious obstruction, and a portion of the Splitting Knife shoals to ease the sharp bend from the main channel at the entrance to the dredged channel will result in a great improvement.

The dredged channel to the wharves is at present 150 feet wide and 9 feet deep, and the history of the work shows that it is maintained only by repeated dredging of the silt and sewage brought down by Town Brook, emptying directly into it, causing shoaling more especially of the enlarged inner end or basin.

A great many passengers are carried annually between Boston and Plymouth on small steamers, and the present facilities slightly improved are ample for the accommodation.

Commercial statistics for the fiscal year ending June 30, 1894, have been furnished by the collector of customs, as follows:

Amount of revenue collected, 1892, $73,808.36; 1893, $47,330.06; 1894, $24,073.13.

Shipping.	1892.		1893.		1894.	
	No.	Tons.	No.	Tons.	No.	Tons.
Entrances:						
Foreign	2	196	3	286	1	159
Domestic	103	.....	108	.....	95	.....
Clearances:						
Foreign	9	1,817	8	1,721	5	1,074

Imported.	1892.	1893.	1894.
Coal.....tons..	16,861	19,094	24,285
Iron.....do...	1,443	650	1,512
Lumber.....feet..	3,303,463	2,085,000	2,260,000
Sand.....tons..	295	140	.....
Miscellaneous.....do..	1,145	2,173	.....

Coasting vessels drawing from 7 to 13 feet frequent the harbor.

In my opinion, and for the reasons stated, the harbor is worthy of additional improvement by the General Government to the extent of

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removing the "Middle Ground" obstructions and of the easterly end of "Splitting Knife" to ease the entrance to the dredged channel.

The harbor was surveyed in 1888, but a survey in the vicinity of the Middle Ground and Splitting Knife shoals will be necessary for a project and estimate of cost, and may be made for $300.

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

B 25.

PRELIMINARY EXAMINATION OF CHATHAM NEW HARBOR, MASSACHUSETTS.

[Printed in House Ex. Doc. No. 69, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1894.

SIR: I have the honor to submit the accompanying copy of report, dated October 29, 1894, by Lieut. Col. S. M. Mansfield, Corps of Engineers, giving results of preliminary examination of Chatham New Harbor, Massachusetts, required by river and harbor act of August 17, 1894.

For the reasons stated, I concur in the opinion of Colonel Mansfield that Chatham New Harbor is not worthy of improvement by the General Government.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF LIEUT. COL. S. M. MANSFIELD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., October 29, 1894.

GENERAL: In accordance with the requirements of letter from your office of August 20, 1894, I have the honor to submit the following report upon the examination of Chatham New Harbor, Massachusetts, as provided in section 10 of the river and harbor act of August 17, 1894:

Chatham New Harbor is located upon the southeastern extremity of Cape Cod, near the entrance to Nantucket and Vineyard sounds, and just north of Chatham Lights. A large coastwise traffic is conducted past this point. It is stated that during the last forty years there have been ashore in the immediate vicinity 318 vessels, including steamers and all other classes. Of this number more than 100, with their cargoes, have been total losses, while it is thought as many more have been obliged, during heavy gales and thick weather, to put to sea as the only alternative to avoid the dangerous Nantucket and Monomoy shoals, which lie in close proximity. A suitable harbor of refuge here would

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be a safeguard to life and property, but, unfortunately, natural conditions for its establishment are unfavorable.

What is designated as Chatham New Harbor is a pool or inlet formed in the drifting sands during a storm in April, 1851, measuring about 1 mile in length, with an average width of 300 yards, within the 6-foot contour; 8 and 10 foot soundings are obtained in the entrance channel of about the same length, and something better inside. Obviously this is inadequate to the requirements of a harbor of refuge for more than small fishing vessels. I am credibly informed that Old Harbor existed a little south of this New Harbor about 1770, and that it moved with the shifting sands to the southward 6 miles and vanished in Monomoy Beach about 1855, and that in earlier days a harbor of like character existed 4 miles to the northward, of which no trace exists. The shoals all along the shore are constantly moving. Even changes are apparent in the present harbor and shoals since 1892, when a plot thereof was made by Captain Eldridge, to whom I am indebted for a copy. There is nothing stable in the conditions, and to establish a harbor here of value to the coastwise navigation will be nearly impossible.

Sixty to a hundred catboats make the harbor in the summer season, with an occasional small yacht or wrecking craft, and for their accommodation the entrance has been buoyed by the Light-House Board.

For reasons stated, I am of opinion that Chatham New Harbor is not worthy of improvement by the General Government.

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

B 26.

SURVEY OF CHELSEA RIVER, MASSACHUSETTS, FROM GRAND JUNCTION RAILROAD BRIDGE TO BOSTON AND MAINE RAILROAD BRIDGE.

[Printed in House Ex. Doc. No. 162, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 27, 1894.

SIR: The river and harbor act of August 17, 1894, provides for a survey of Chelsea River, Massachusetts, from Grand Junction Railroad Bridge to Boston and Maine Railroad Bridge.

The duty of making this survey was assigned to Lieut. Col. S. M. Mansfield, Corps of Engineers, and I have now the honor to submit the accompanying copy of his report of December 21, 1894, with map,* on the subject.

The plan of improvement proposed by Lieutenant-Colonel Mansfield is to dredge a cut 150 feet wide and 18 feet deep at mean high water, at an estimated cost of $65,000.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

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*Omitted. Printed in House Ex. Doc. No. 162, Fifty-third Congress, third session.

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REPORT OF LIEUT. COL. S. M. MANSFIELD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., December 21, 1894.

GENERAL: I have the honor to forward herewith a tracing* of Chelsea River, Massachusetts, from Grand Junction Railroad Bridge to Boston and Maine Railroad Bridge, made in accordance with Department instructions of September 1, 1894, and to comply with the provisions of the river and harbor act of August 17, 1894.

The plan is compiled from a survey made in 1893 by the Massachusetts Harbor and Land Commissioners. It correctly exhibits the present condition of the channel. The report of the preliminary examination is dated October 26, 1892, and I respectfully invite attention to it for a general description of the channel, for its commercial importance, and the reasons for making the survey.

As seen by the drawing, the present channel, for a distance of 2,000 feet above the Grand Junction Bridge, is sufficiently wide and deep to meet any demands of navigation. Above this point to the head of navigation is indicated on the tracing the project which I respectfully recommend for the improvement of the channel, viz, to dredge a cut 150 feet wide and 18 feet deep at mean high water.

The cost of this improvement is estimated as follows:

Dredging 234,000 cubic yards, at 25 cents per cubic yard	$58,500
Contingencies	6,500
Total	65,000

Chelsea River is in the collection district of Boston, Mass., of which Boston is the port of entry. The nearest light-house is on Long Island, Boston Harbor, Massachusetts.

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

B 27.

SURVEY OF EAST BOSTON CHANNEL, BOSTON HARBOR, MASSACHUSETTS.

[Printed in House Ex. Doc. No. 58, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1894.

SIR: I have the honor to inclose a copy of report, with map,† dated October 15, 1894, submitted by Lieut. Col. S. M. Mansfield, Corps of Engineers, under the terms of the river and harbor act of August 17, 1894, which provides for a survey of East Boston Channel, Massachusetts.

The project proposed by Lieutenent-Colonel Mansfield is to dredge a cut 150 feet wide, 10 feet deep at mean low water from deep water in

* Omitted. Printed in House Ex. Doc. No. 162, Fifty-third Congress, third session.
† Omitted. Printed in House Ex. Doc. No. 58, Fifty-third Congress, third session.

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the Jeffreys Point Channel to near the sea wall of the Boston, Revere Beach and Lynn Railroad, at an estimated cost of $60,000.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF LIEUT. COL. S. M. MANSFIELD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., October 15, 1894.

GENERAL: I have the honor to forward herewith a tracing* of the East Boston Channel, Boston Harbor, Massachusetts, made in accordance with Department instructions of September 1, 1894, and to comply with the provisions of the river and harbor act of August 17, 1894.

The plan is compiled from surveys made in 1890 under the direction of this office, and in 1893 under the direction of the Massachusetts Harbor and Land Commissioners. It correctly exhibits the present condition of the channel.

The report of the preliminary examination† is dated October 27, 1892, and I respectfully invite attention to it for a general description of the channel, for its commercial importance, and the reasons for making the survey.

As seen by the tracing, the channel is nearly dry at mean low water, and it lies wholly within the harbor line approved by the Secretary of War June 2, 1890.

On the tracing is indicated the project which I respectfully recommend for the improvement of the channel, viz: To dredge a cut 150 feet wide, 10 feet deep at mean low water from deep water in the Jeffreys Point Channel to near the sea wall of the Boston, Revere Beach and Lynn Railroad.

The cost of this improvement is estimated as follows:

Dredging 212,000 cubic yards, at 26 cents	$55,120
Contingencies	4,880
Total	60,000

East Boston Channel is in the collection district of Boston, Mass., of which Boston is the port of entry. The nearest light-house is on Long Island, Boston Harbor, Massachusetts.

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

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* Omitted. Printed in House Ex. Doc. No. 58, Fifty-third Congress, third session.
† Printed in Annual Report of the Chief of Engineers for 1893, pp. 793–800.

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B 28.

SURVEY OF SALEM HARBOR, MASSACHUSETTS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., April 18, 1895.

GENERAL: I have the honor to submit the following report upon a survey of Salem Harbor, Massachusetts, with a plot of said survey on a scale of 1:5000, made in accordance with the requirements of "An act making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes," approved August 17, 1894:

Salem Harbor, Massachusetts: So much of the appropriation heretofore made as may be necessary shall be used in making a survey of Salem Harbor, with a view to widening the harbor channel to the mouth of South River to the width of five hundred feet, and giving a depth of at least ten feet at mean low water, and from the mouth of said river to Derby Wharf, beginning with a width of three hundred feet and gradually narrowing, so that there shall be at said wharf a width of not less than one hundred and sixty feet and a depth from said mouth to said wharf of not less than ten feet at mean low water, and with a view of dredging the "Middle Ground," so called, between "Haste Ledge" and "Aqua Vitæ" so as to give a depth of twenty-five feet at mean low water.

This survey was made by U. S. Assistant Engineer T. T. Hunter Harwood, assisted by Mr. Charles W. Mason, U. S. hydrographer, during the months of September to December, 1894, and attention is respectfully invited to Mr. Harwood's accompanying report for the details thereof.

Salem Harbor is about 12 miles north of Boston. The approach is through a bay well sheltered from the sea by a range of islands and shoals extending northeastwardly from Marblehead Neck. It embraces about 110 acres of well sheltered and unobstructed anchorage ground of a greater depth than 18 feet at mean low water.

A light-house on the end of Derby Wharf marks the entrance to South River, which is reached through a channel 8 feet deep, 300 feet wide at the outer end, and 150 feet wide opposite the light, dredged by the United States in 1891–1894. This channel of 8 feet was continued up the river and gradually narrowed to 100 feet near the inner end of Derby Wharf. From thence to the head of navigation the channel was made 50 feet wide and 6 feet deep. The length of this dredged channel is 3,000 feet and is found substantially unchanged.

The harbor channel to the mouth of South River has a greater width than 500 feet, and a depth of at least 10 feet at mean low water. To improve the river from its mouth to Derby Wharf, beginning with a width of 300 feet and gradually narrowing so that there shall be at said wharf a width of not less than 160 feet and a depth from said mouth to said wharf of not less than 10 feet at mean low water, will require the removal of 48,791 cubic yards of material measured in scows, which at 25 cents per cubic yard will cost $12,198; to this amount should be added contingencies, $1,802, making the total cost $14,000.

The outer harbor or bay before mentioned is an excellent harbor of refuge. It has an area of about 320 acres not less than 25 feet deep and about 457 acres not less than 18 feet deep. A channel 1,000 feet wide and 25 feet deep connects it with the open sea.

The shoal known as the "Middle Ground," covering the bay from the south and east, is 293.8 acres in area, shoaler than 18 feet at mean low water, and embraces the small island called "Great Haste" and the two shoals, bare at low water, "Great Aqua Vitæ" and "Little Aqua

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Vitæ." To remove this "Middle Ground," so called, between "Haste Ledge" and "Aqua Vitæ" so as to give a depth of 25 feet at mean low water, calls for the dredging of a channel 8,400 feet long, 500 feet wide, and 25 feet deep, measuring 1,617,846 cubic yards in situ, or 1,941,415 cubic yards in scows, which at 25 cents per cubic yard will cost $485,353, to which should be added contingencies of $49,647, making the total cost $535,000.

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

REPORT OF MR. T. T. HUNTER HARWOOD, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., February 12, 1895.

COLONEL: I have the honor to submit the following report upon the survey of Salem Harbor, Massachusetts, made in the months of September to December, 1894, in accordance with your instructions, and with it a map of the survey, drawn to a scale of 1:5000.

TOPOGRAPHY.

Salem Harbor is about 12 miles north of Boston, Mass. Fort Pickering Light marks the entrance to the harbor proper, between Naugus Head on the east and Winter Island on the west. The approach to this entrance is through a well-sheltered bay bounded on the south, west, and north by the mainland, and on the east by a system of islands and shoals extending northeastward from Marblehead Neck. This bay is limited in useful area on the south by a large shoal lying between Great Aqua Vitæ and Great Haste Island.

Seven primary triangulation stations were located and occupied. From these points the positions of the light-houses and other aids to navigation were determined, and the distance between Hospital Point and Fort Pickering Lights (7,820.9 feet) as computed from data contained in the United States Coast Survey table of geographical positions was taken as a base for computation. From the positions of these two lights the survey was also oriented, and from suitable points of the triangulation systems of ranges were established on which soundings were taken over the areas desired.

The high-water lines were taken from the United States Coast Survey chart of 1851.

HYDROGRAPHY.

The area covered by the survey is about 4 square miles, and includes all of the outer bay inclosed by the mainland and a meridional line about 2 miles east of the longitude of Fort Pickering Light.

A survey was also made of the channel of approach to the mouth of South River to determine its present condition.

All other hydrography of the inner harbor was taken from a survey made by the U. S. Engineers in 1889.

One hundred and thirty-two ranges were sounded in the outer bay and 30 ranges in the inner harbor, aggregating 159 miles in length, on which 46,583 soundings were taken, 8,037 of which were intersected with a transit from shore stations. The soundings on the map are selected as characteristic of the many taken in the survey. They are expressed in feet and tenths and refer to the plane of mean low water.

The bench mark is the top of the tenth course of brickwork of the Derby Wharf Light Tower, 13.97 feet above mean low water.

DESCRIPTION OF SALEM HARBOR, AS DEVELOPED BY THE SURVEY.

In approaching the harbor by the main ship channel from the eastward, vessels whose pilots lack a local knowledge of the approaches bring the Bakers Island Lights to bear W. by N. and run in on that course until Hospital Point Light bears W. by N. ¾ N.; this latter course is then steered, which carries them through the outlying islands and shoals between Bakers Island and Little Misery Island into the inner bay. Continuing on this course, Fort Pickering Light is brought to bear S. W. by W. ½ W.,

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when the course is changed for this light until the entrance to the harbor is opened S. W. ¼ W., which course is pursued to an anchorage in the inner harbor.

A subsketch traced from the United States Coast Survey chart is placed on the map illustrating the approaches to Salem Harbor and has these courses upon it. They are also indicated on the map.

The anchorage ground in the inner harbor is about 110 acres in extent, of a greater depth than 18 feet at mean low water, and is well sheltered and entirely unobstructed.

On the outer end of Derby Wharf, at the head of the harbor, a small light-house, called Derby Wharf Light, marks the mouth of South River, which is reached from deep water by a channel dredged by the United States in 1891–1894. This channel when completed was 1,730 feet long, 300 feet wide at the outer end, 150 feet wide at Derby Wharf Light, and 8 feet deep at mean low water.

The survey shows that this channel of approach has essentially preserved its original dimensions, but a shoaling is noticeable in places, particularly on its northern side.

The channel in South River, commencing at Derby Wharf Light, is 150 feet wide, 8 feet deep at mean low water, and gradually narrows to 100 feet near the inner end of Derby Wharf. From this point to the head of navigation it is 50 feet wide and 6 feet deep at mean low water. This channel was dredged by the United States in 1891–1894, and its total length is 3,000 feet.

The outer harbor or bay, before referred to in this report, is used as a harbor of refuge by coasting vessels seeking shelter from easterly storms. As developed by the survey, it has an area of about 320 acres deeper than 25 feet at mean low water and about 457 acres deeper than 18 feet. It is obstructed only by a few small shoals on the western side, and the 25-foot channel connecting it with the sea is 1,000 feet wide at its narrowest point north of Little Haste Beacon. The 18-foot channel through it from the sea into the inner harbor is 1,300 feet wide at its narrowest point, between Abbott's Rock Beacon and Great Aqua Vitæ.

The anchorage area deeper than 25 feet at mean low water in the inner harbor is only about 25 acres, lying directly in the entrance, and the 25-foot channel connecting it with the outer bay is but 175 feet wide at its narrowest point east of Winter Island.

The shoal known as the "Middle Ground," bounding the outer bay on the south, is 293.8 acres in area shoaler than 18 feet at mean low water and embraces in that area the small island called "Great Haste" and two shoals, Great Aqua Vitæ and Little Aqua Vitæ, dry at low water. Below the plane of 18 feet below mean low water the "Middle Ground" loses its identity as a separate shoal, merging into the common shoal ground extending northeast from the peninsula which forms Salem Harbor on the east.

Twenty-nine borings were made over this shoal by means of the water jet to determine the nature of the material of which it is composed. With one exception (No. 28), these borings were sunk to a greater depth than 25 feet below mean low water, and from them the shoal appears to be composed of sand and gravel. At the position of boring No. 28, clear ledge was found at a depth of 24 feet, and from the general indications of the surroundings of the shoal it may be expected that other ledges not developed by the borings will be found underlying it in the event of its removal.

A table of the borings is placed upon the map.

The operations of the surveying party in the field were in charge of Mr. Charles W. Mason, U. S. Hydrographer.

Very respectfully, your obedient servant,

T. T. HUNTER HARWOOD,
Assistant Engineer.

Lieut. Col. S. M. MANSFIELD,
Corps of Engineers.

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APPENDIX C.

IMPROVEMENT OF RIVERS AND HARBORS IN SOUTHEASTERN MASSACHUSETTS, IN RHODE ISLAND, AND IN EASTERN CONNECTICUT.

REPORT FOR THE FISCAL YEAR ENDING JUNE 30, 1895, WITH OTHER DOCUMENTS RELATING TO THE WORKS. OFFICERS IN CHARGE, CAPT. W. H. BIXBY AND LIEUT. WILLIAM W. HARTS, CORPS OF ENGINEERS.

IMPROVEMENTS.

1. Harbor of refuge at Hyannis, Mass.
2. Harbor of refuge at Nantucket, Mass.
3. Marthas Vineyard, inner harbor at Edgartown, Mass.
4. Harbor at Vineyard Haven, Mass.
5. Harbor of refuge at Woods Hole, Mass.
6. Wareham Harbor, Massachusetts.
7. New Bedford Harbor, Massachusetts.
8. Canapitsit Channel, Massachusetts.
9. Taunton River, Massachusetts.
10. Pawtucket River, Rhode Island.
11. Providence River and Narragansett Bay, Rhode Island.
12. Green Jacket Shoal, Providence River, Rhode Island.
13. Newport Harbor, Rhode Island.
14. Harbor of refuge at Point Judith, Rhode Island.
15. Entrance to Point Judith Pond, Rhode Island.
16. Harbor of refuge at Block Island, Rhode Island.
17. Pawcatuck River, Rhode Island and Connecticut.
18. Harbor of refuge at Stonington, Conn.
19. Removing sunken vessels or craft obstructing or endangering navigation.

EXAMINATIONS AND SURVEYS.

20. Mount Hope Bay and Harbor of Fall River, Mass.
21. Stone bridge over Sakonnet River, Rhode Island.
22. Onset Harbor, Massachusetts.
23. Bass River, Massachusetts.
24. Hyannis Harbor, Massachusetts.
25. Conanicut Island, Rhode Island.
26. Seaconnet Point, Rhode Island.
27. Woods Hole and Little Woods Hole Harbor, Massachusetts.
28. Wickford Harbor, Rhode Island.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., July 10, 1895.

GENERAL: I have the honor to submit herewith annual reports for the fiscal year ending June 30, 1895, of the river and harbor works under charge of Capt. W. H. Bixby, Corps of Engineers, and at present temporarily under my charge.

In the work of this year this office has been assisted by Assistant Engineers Edward Parrish and John H. Rostock.

Very respectfully, your obedient servant,

WM. W. HARTS,
First Lieut., Corps of Engineers.

Brig. Gen. WM. P. CRAIGHILL,
Chief of Engineers, U. S. A.

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C 1.

HARBOR OF REFUGE AT HYANNIS, MASSACHUSETTS.

The harbor of Hyannis lies on the south shore of the peninsula of Cape Cod, about 15 miles to the westward of the heel of the cape, and is an important harbor of refuge. (For map, see p. 592, Annual Report of 1884.)

The mean rise and fall of the tide is about 3¾ feet.

Original condition.—Before improvement it was an open roadstead, exposed to southerly storms, with depths varying from 10 to 20 feet in the inner harbor.

In the years 1827–1838 a breakwater of riprap granite, 1,170 feet long, was constructed, covering an anchorage of about 175 acres, the entrance to which had a depth of about 15½ feet. In the years 1852–1882 extensive repairs were made in increasing the width of its base and the size of the stone forming its sides and top. About $124,000 was spent on this work, completed in 1882.

At the adoption of the present project the 15.5 feet depth anchorage covered only about 47 acres, and the 36 additional acres to be dredged carried an average of about 12 feet depth of water at low water.

Plan of improvement.—The present approved project, that of 1884, provides for the dredging to 15.5 feet depth at low water of about 36 acres of shoal area north of the existing breakwater, so as to increase the deep-water harborage by that amount; all at a total cost estimated in 1884 at $45,743.20 (including $81.20 left over from a former project).

A plan of the works may be found at page 560, Annual Report of the Chief of Engineers for 1885, and page 804 of 1893, and further information at page 621 of 1885.

Appropriations.—Upon the present project appropriations have been made as follows: On hand, 1884, $81.20; 1886, $10,000; 1888, $10,000; 1890, $8,000; 1892, $6,000; 1894, $3,500; totals up to June 30, 1895, $37,581.20.

Amount expended and results to June 30, 1894.—The total amount expended on the present project (including $147.44 of outstanding liabilities) up to June 30, 1894, was $33,573.13, by which 20 acres out of 36 had been dredged.

Operations during the past fiscal year.—Value of United States plant, $6,230. Including $12.13 of outstanding liabilities on June 30, 1895, the expenses of the year were $668.48.

In August a project was submitted and approved for the expenditure of the new appropriation of August 17, 1894, the main work of dredging to be done by contract, but other work to be done by hired labor and the purchase of materials in open market. Under this appropriation bids for dredging were solicited and received, and a contract for about $2,000 worth of work was entered into with the Hartford Dredging Company, of Hartford, Conn., at 17.3 cents per cubic yard, under date of April 13, and approved by the Chief of Engineers April 30, 1895; work (together with that at New Bedford, Edgartown, and Canapitsit) to be commenced by June 1, 1895 (later extended to September 10, 1895), and to be completed September 1, 1896. Further dredging now awaits the commencement of work by the contractors.

This work was in the local charge of Mr. Edward Parrish as assistant engineer.

Work required to complete the existing project.—The work still required to complete the existing project is the completion of the dredging to a

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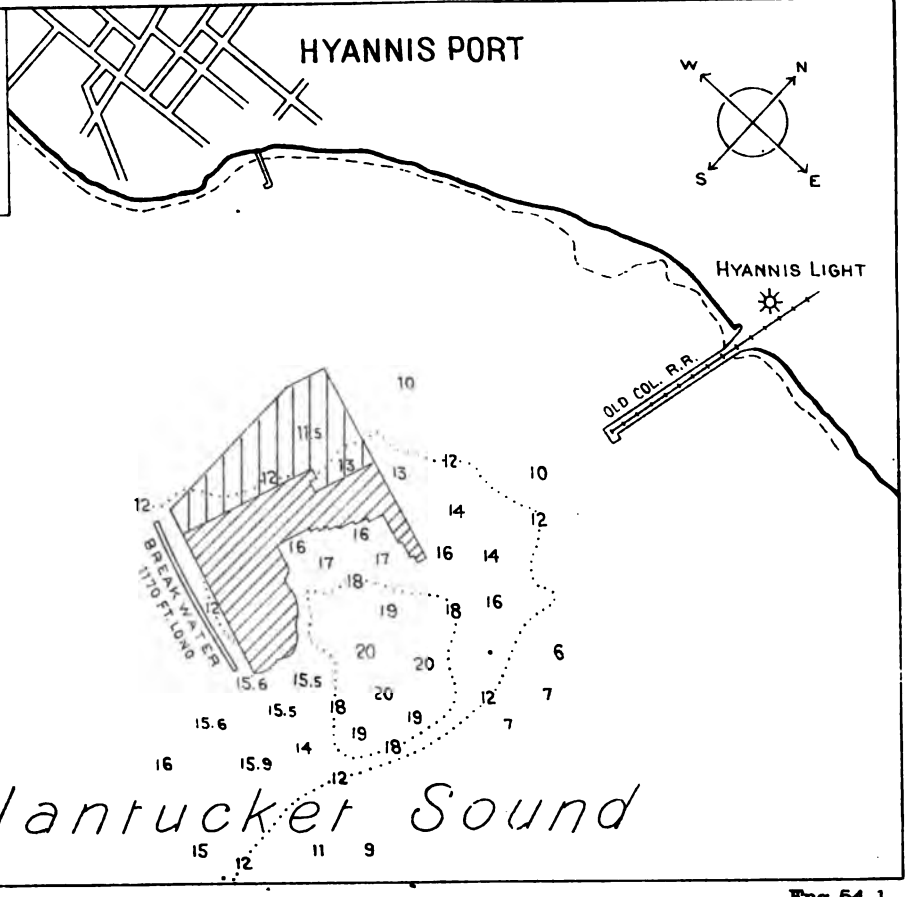
PROPOSED WORK
HARBOR OF REFUGE
AT
HYANNIS, MASS.



ANCHORAGE BASIN

Scale

100 0 500 1000 1500 2000 FEET

Based on map made 1884 under direction of Newport Engineer Office, U.S.A. Reduced and drawn by P. Brosig 1893

BENCH MARK (NAIL IN S. FACE OF L.H.) = +25.673 AT M.L.W.
MEAN RISE AND FALL OF TIDE IS 3.4 FEET.

——— SHORE LINE AT MEAN HIGH WATER
– – – – – – SHORE LINE AT MEAN LOW WATER
·····18····· CONTOURS & DEPTHS (FEET) AT M.L.W.

DREDGING TO 15,5 FT. DEPTH AT M.L.W.
" PRIOR TO JUNE 30. 1894.
" TO BE DONE.

Newport, R.I. July 1895
Official
Wm. W. Hartz
1st. Lieut., Corps of Engineers, U.S.A.

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depth of 15½ feet over the remaining 16 acres in the area limited on the west by a line running due north from the western end of the breakwater and on the north by a line running parallel to the breakwater and distant 500 feet from it, and leaving a berm of 100 feet along the northern side of the breakwater.

Operations contemplated for the fiscal year ending June 30, 1896.—It is proposed to apply the balance on hand and the new appropriation toward the completion of the anchorage area inside the breakwater.

Hyannis Harbor is in the Barnstable collection district, and Barnstable is the nearest port of entry. The amount of revenue collected at Barnstable in the last calendar year was $438.69.

The main value of the harbor is for a harbor of refuge. The nearest light-house is Hyannis Light; the nearest fortification is the fort at Clarks Point, New Bedford, Mass.

Money statement.

July 1, 1894, balance unexpended		$655.51
Amount appropriated by act of August 17, 1894		3,500.00
		4,155.51
June 30, 1895, amount expended during fiscal year		797.49
July 1, 1895, balance unexpended		3,358.02
July 1, 1895, outstanding liabilities	$12.13	
July 1, 1895, amount covered by uncompleted contracts	2,000.00	
		2,012.13
July 1, 1895, balance available		1,345 89
Amount (estimated) required for completion of existing project		8,162.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		8,162.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals opened March 20, 1895, at Newport, R. I., by Capt. W. H. Bixby, U. S. Engineers, for dredging in the harbor at Hyannis, Mass.

[Quantity required, about $2,000 worth of work.]

No.	Name and address of bidder.	Price per cubic yard—	
		On this work alone.	In connection with other work.
1	Hartford Dredging Co., Hartford, Conn.	$0.173	*$0.173
2	Columbia Dredging Co., Fall River, Mass.	.....	†.235
3	Elijah Brainard, New York	.....	‡.25

* With 3 other works. † With 1 other work. ‡ With 2 other works.

Contract awarded to Hartford Dredging Company at $0.173.

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COMMERCIAL STATISTICS.

The commerce arriving and leaving Hyannis Harbor, Massachusetts, by water during the calendar year ending December 31, 1894, is estimated as follows (based mainly upon reports received from Mr. Thomas C. Day, collector of customs, Barnstable, Mass., and from T. Crocker & Sons, Hyannis, Mass.):

Class of goods.	Exports.	Imports.	Total.	
			Value.	Tons.
Tobacco	.....	$600	$600	5
Rice	.....	75	75	2
Grains and forage	.....	36,200	36,200	1,000
Vegetables and truck	$250	500	750	80
Live stock and products	750	5,213	5,963	134
Fish, oysters, etc	3,850	1,500	5,350	195
Lumber and products	12,000	32,000	44,000	2,400
Coal, minerals, and products	.....	75,000	75,000	14,500
Fertilizers	.....	1,000	1,000	50
General merchandise	.....	27,000	27,000	270
Total	16,850	179,088	195,938	18,636

Gain over last year, nothing; new transportation companies established during the year, none.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam:			
Freight and passenger	25	8	175
Freight, mainly	45	12	450
Passenger, mainly	4,000	10	450
Fishing	25	7	65
Tugs	75	12	80
Pleasure boats	60	6	20
Sail:			
Freight	500	11	300
Fishing boats	300	2	5
Pleasure boats, large	25	12	150
Pleasure boats, small	100	4	7
Barges	15	.....	550

C 2.

HARBOR OF REFUGE AT NANTUCKET, MASSACHUSETTS.

Nantucket Harbor is the only large harbor on Nantucket Sound between the harbors of Marthas Vineyard (Vineyard Haven and Edgartown) and Provincetown, a distance of about 100 miles, except the small harbor of Hyannis, on the other (the north) side of Nantucket Sound. The navigation of this sound is intricate and dangerous by reason of numerous shoals. Nantucket Harbor has deep water inside, and the object of the improvement is to make it a harbor of refuge for vessels plying between ports north and south of Cape Cod, estimated to be 50,000 annually. In the memorial to Congress, on which the first appropriation for this harbor of refuge was based, it was stated that more than 500 vessels had been wrecked in the vicinity of the island. (For map of harbor see p. 423, Annual Report of 1880, and p. 576 of Report of 1885.)

The mean rise and fall of the tide is about 3 feet.

Original condition.—At the adoption of the present project no jetties existed, and the channel entrance was barred by a shoal of 1.5 miles

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width, on which there was only 6 feet depth of water at low tide, the channel being very crooked and subject to changes in location.

Plan of improvement.—The present approved project, that of 1880, as modified in 1885, provides for the construction of two jetties as training walls, one on each side of the harbor entrance, planned so as to allow the tidal current to assist in scouring out and maintaining a good channel, and for the completion of the work by dredging where necessary to obtain a depth of from 12 to 15 feet at low water in this channel, all at a total cost estimated in 1885 at $375,000.

A plan of the works may be found at page 578, Annual Report of the Chief of Engineers for 1885, and page 806 of 1893; and further information at page 436 of 1880, page 544 of 1881, page 595 of 1884, and pages 563, 575, 578 of 1885.

Appropriations.—Upon the present project appropriations have been made as follows: 1880, $50,000; 1881, $25,000; 1882, $25,000; 1884, $10,000; 1886, $15,000; 1888, $20,000; 1890, $25,000; 1892, $25,000; 1894, $25,000. Total up to June 30, 1895, $220,000.

Amount expended and results to June 30, 1894.—The total amount expended on the present project (including $3,570.96 outstanding liabilities) up to June 30, 1894, was $179,036.14, by which the west jetty had been built to 3,955 feet length with full height; the east jetty had been built to 834 feet length with full height; then the foundation laid for a length of 191 feet; then came a gap of 160 feet; then 1,300 feet length raised to half-tide level; and then 420 feet length raised to nearly low tide; the total length from shore end to outer end being now 2,905 feet, completing nearly two-thirds of the needed work. The channel has been deepening from year to year and moving to the eastward somewhat. There is now already a depth of 8 feet in the channel, whereas before improvement it was only 6 feet depth.

Operations during the past fiscal year.—Value of United States plant, $5,885. Including $3,112.07 of outstanding liabilities on June 30, 1895, the expenses of the year were $19,250.36.

Stonework in progress at commencement of year was continued by the contractor until August 31, by which 1,240 tons of core and 2,690 tons of facing stone were placed in the east jetty and around the spindles placed to mark its course, bringing the jetty up to within about 1.5 feet of mean low water for the entire length of 1,030 feet built under such contract, making this east jetty 3,515 feet long from the shore end to its outer end; and 3,030 tons of facing stone were placed on the west jetty leveling up the outer 3,025 feet length of jetty from about the high-water line on shore out to the lantern staff near the outer end, thus completing all contract work under the 1892 appropriations. In August a project was approved for the expenditure of the new appropriation of August 17, 1894; the main stone work to be done by contract, but other work to be done by hired labor and purchase of materials in open market. Under this appropriation, bids for stonework were received and contract for about $18,000 worth of work entered into with Humphrey Toomey, of Guilford, Conn., under date of April 6, approved by the Chief of Engineers April 19, at $1.59 per ton of 2,000 pounds in place in the east jetty; work to be commenced by May 15 (later extended to May 29) and completed by December 15, 1895. Actual work was commenced by the contractor on June 1, 1895, and was in progress at the end of the year; 649 tons of core stone and 1,435 tons of facing stone being placed in the east jetty, thereby extending it by 120 feet.

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A light has been maintained on the west jetty during the year, and a temporary light was established in October to mark the end of the stonework on the east jetty.

This work was in the local charge of Mr. Edward Parrish as assistant engineer, with Mr. C. O. Abel as inspector.

Work required to complete the existing project.—The work required to complete the existing project is the further extension of the east jetty, the raising of the west jetty in some low places, and the excavation by dredging of so much of the channel as may not be excavated by tidal scour.

Operations contemplated for the fiscal year ending June 30, 1896.—According to the present plan, it is proprosed to build up a considerable length of the east jetty to the half-tide level before completing it to the full cross section, to prevent much scour in one place around the end of the unfinished jetty.

It is at present proposed to apply the balance on hand and the next appropriation to the further construction of the east jetty and raising low places in the west jetty, together with a little dredging, if necessary.

Nantucket is in the Nantucket collection district and is a port of entry. No revenue was collected during the last calendar year. The value of the harbor is mainly as a harbor of refuge. The nearest light-houses are Nantucket Cliff and Brant Point lights. The nearest fortification is the fort at Clark Point, New Bedford, Mass.

Money statement.

July 1, 1894, balance unexpended		$19,534.82
Amount appropriated by act of August 17, 1894		25,000.00
		44,534.82
June 30, 1895, amount expended during fiscal year		19,709.25
July 1, 1895, balance unexpended		24,825.57
July 1, 1895, outstanding liabilities	$3,112.07	
July 1, 1895, amount covered by uncompleted contracts	15,390.48	
		18,502.55
July 1, 1895, balance available		6,323.02
Amount (estimated) required for completion of existing project		155,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals, opened March 29, 1895, at Newport, R. I., by Capt. W. H. Bixby, U. S. Engineers, for supplying and placing stone in the east jetty at Nantucket Harbor, Massachusetts.

[Quantity required, about $18,000 worth of work.]

No.	Name and address of bidder.	Price per ton.
1	Chas. F. Stoll, New London, Conn	$2.85
2	Pigeon Hill Granite Co., Rockport, Mass	1.71
3	S. & E. S. Belden, Hartford, Conn	1.73
4	Humphrey Toomey, Guilford, Conn	1.59
5	Rockport Granite Co., Rockport, Mass	1.87
6	Wm. H. Molthrop & Co., New Haven, Conn	1.95
7	Hughes Bros. & Bangs, Syracuse, N. Y	1.87

Contract awarded to Humphrey Toomey at $1.59.

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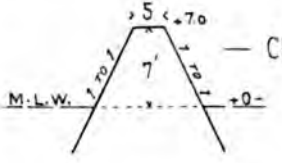
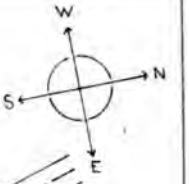
PROGRESS MAP FOR 1895
HARBOR OF REFUGE AT NANTUCKET, MASS.
FROM 1. JULY 1894 TO 30. JUNE, 1895

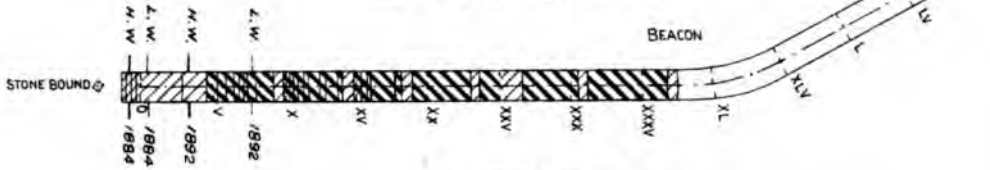
SHEET 1

— CROSS SECTION —





— TOP PLAN —



WEST JETTY

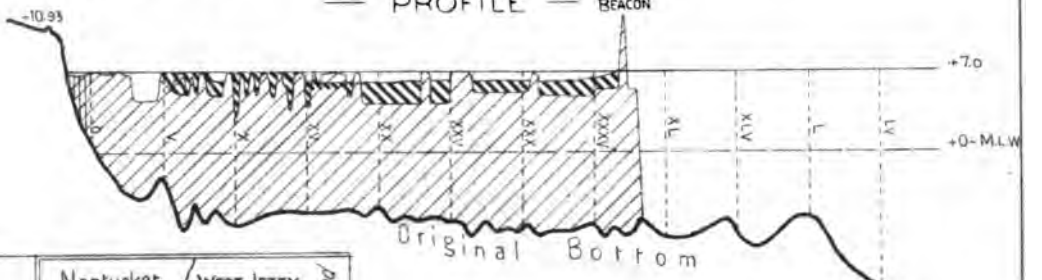
Scales

LENGTHS
100 0 500 1000 1500 2000 FT.

WIDTHS
10 5 10 15 20 FT.

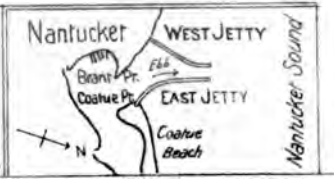
DEPTHS & HEIGHTS
10 5 10 FT.

— PROFILE —



WORK DONE

- SHORE EXTENSION PRIOR TO JUNE 30. 1894
- DURING FISCAL YEAR 1894/95
- UNCOMPLETED OR PROPOSED



MEAN RISE AND FALL OF TIDE IS ABOUT 3.0 FT.

Based on maps made 1881-1892 under direction of the Newport U.S. Engr. Office
Compiled, reduced & drawn in office of Capt. W.H. Bixby, U.S. Engrs. by P. Brosig

Newport, R.I. *July 1895*

Respectfully submitted

Wm. M. Harts

1st Lieut., Corps of Engineers, U.S.A.

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PROGRESS MAP FOR 1895
HARBOR OF REFUGE
AT
NANTUCKET, MASS.
FROM 1. JULY 1894 TO 30. JUNE 1895

SHEET 2

EAST JETTY

Scales

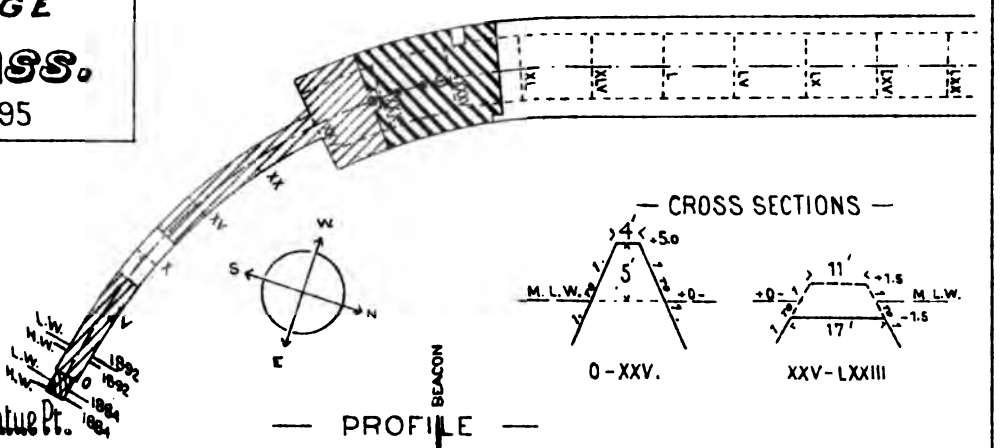
LENGTHS
100 0 500 1000 1500 2000 FT.

WIDTHS
10 5 10 15 20 FT.

DEPTHS & HEIGHTS
10 5 10 FT.

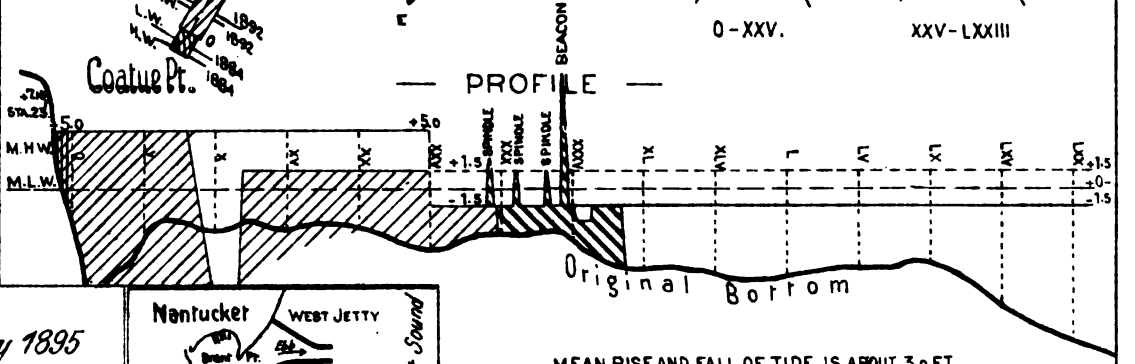
WORK DONE
- SHORE EXTENSION
- PRIOR TO JUNE 30. 1894.
- DURING FISCAL YEAR 1894/95.
- UNCOMPLETED OR PROPOSED

— TOP PLAN —

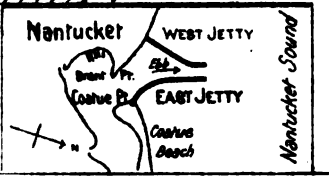


— CROSS SECTIONS —

— PROFILE —



MEAN RISE AND FALL OF TIDE IS ABOUT 3.0 FT.
Based on maps made 1881 - 1892 under direction of the Newport U.S. Engr. Office
Compiled, reduced & drawn in office of Capt. W. H. Bixby, U.S. Engrs. by P. Brosig.



Newport, R.I. *July 1895*

Respectfully submitted

Wm. N. Hartz

1st Lieut, Corps of Engineers, U.S.A.

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COMMERCIAL STATISTICS.

The commerce arriving and leaving Nantucket Harbor, Massachusetts, by water during the calendar year ending December 31, 1894, is estimated as follows (based mainly upon reports received from Mr. Joseph W. Clapp, collector of customs, who also reports unusual dullness in all business during the year):

Class of goods.	Exports.	Imports.	Total.	
			Value.	Tons.
Tobacco	.....	$35,000	$35,000	.....
Rice	.....	6,000	6,000	40
Grains and forage	.....	35,000	35,000	650
Vegetables and truck	$1,000	12,000	13,000	600
Live stock and products	5,000	5,000	10,000	20
Fish, oysters, etc	14,000	2,500	16,500	450
Naval stores	.....	1,000	1,000	10
Lumber and products	.....	15,000	15,000	1,500
Coal, minerals, and products	.....	50,000	50,000	8,000
Fertilizers	.....	8,000	8,000	400
Machinery and hardware	.....	20,000	20,000	150
General merchandise	.....	115,000	115,000	1,550
Sundries	.....	6,000	6,000	160
Total	20,000	310,500	330,500	13,530

This list shows a slight gain over last year in exports, but a considerable loss in imports and a total loss in all commerce of about 1,500 tons.

New transportation companies established during the year, none.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam:			
Freight and passenger	450	7–8	500
Freight mainly	3	7	500
Passenger mainly	1	5	50
Fishing	2	4	7
Tugs	1	5	5
Pleasure boats	12	5	5
Sail:			
Freight	3	8	500
Fishing boats	2	4	7
Pleasure boats, large	21	5	4
Pleasure boats, small	25	3	3

C 3.

IMPROVEMENT OF MARTHAS VINEYARD INNER HARBOR AT EDGARTOWN, MASS.

The inner harbor at Edgartown lies in the northern part of the waterway or straight that separates Chapaquiddick Island from the east end of Marthas Vineyard. It extends southward about 1½ miles from Chappaquiddick Point, opposite Edgartown, and averages about one fifth of a mile in width.

This harbor is so completely landlocked as to form a safe harbor of refuge for small vessels, but the contracted width of the entrance and the resulting velocity of the tidal currents make it difficult to pass through. (For map of this harbor see House Ex. Doc. No. 59, Fifty-first Congress, first session.)

Original condition.—At the adoption of the present project the middle ground shoal carried only about 6 feet depth of water, and was a very troublesome obstruction.

Plan of improvement.—The present approved project, that of 1889, provides for the removal to 10 feet depth at low water of a "middle-

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ground" shoal in the central part of the inner harbor; all at a total cost estimated in 1893 at $7,000.

A description of the works may be found at page 588, Annual Report of the Chief of Engineers for 1890, and a plan of the same in House Ex. Doc. No. 59, Fifty-first Congress, first session, and page 810, Annual Report of 1893; and other special information at page 809, Annual Report of 1893.

Appropriations.—Under the present project appropriations have been made as follows: 1890, $2,000; 1892, $2,500; 1894, $2,500. Total up to June 30, 1895, $7,000.

Amount expended and results to June 30, 1894.—The total amount expended on the present project (including $6.70 outstanding liabilities) up to June 30, 1894, was $4,498.59, by which about three-quarters of the shoal had been dredged to full depth.

Operations during the past fiscal year.—Value of United States plant, $140. Including $13.74 of outstanding liabilities on June 30, 1895, the expenses of the year were $347.95.

In August, a project was submitted and approved for the expenditure of the new appropriation of August 17, 1894; the main work of dredging to be done by contract, but other work to be done by hired labor and the purchase of materials in open market. Under this appropriation, and in accordance with this project, bids for dredging were solicited and received, and a contract for about $1,200 worth of work entered into, under date of April 13 (approved by the Chief of Engineers on April 30) with the Hartford Dredging Company, of Hartford, Conn., at 27.5 cents per cubic yard; work to be commenced by June 1, 1895 (later extended to September 10, 1895), and to be completed (in connection with work at Hyannis, New Bedford, and Canapitsit) by September 1, 1896. A minor survey was made in December to determine the amount of dredging still necessary to complete the project. Further dredging now awaits the commencement of field work by the contractors.

This work of improvement was in the local charge of Mr. E. Parrish as assistant engineer, and the survey work was under Mr. J. H. Rostock, assistant engineer.

Work required to complete the existing project.—The work required to complete the existing project is the excavation of the remaining quarter of the middle-ground to a depth of 10 feet at mean low water.

Operations contemplated for the fiscal year ending June 30, 1896.—It is proposed to complete the project.

Edgartown is in the Edgartown collection district and is a port of entry. The amount of revenue collected there during the last calendar year was $365.57. The nearest light-house is the Edgartown Light. The nearest fortification is the fort at Clark Point, New Bedford, Mass.

Money statement.

July 1, 1894, balance unexpended		$8.11
Amount appropriated by act of August 17, 1894		2,500.00
		2,508.11
June 30, 1895, amount expended during fiscal year		340.91
July 1, 1895, balance unexpended		2,167.20
July 1, 1895, outstanding liabilities	$13.74	
July 1, 1895, amount covered by uncompleted contracts	1,200.00	
		1,213.74
July 1, 1895, balance available		953.46

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PROPOSED WORK

MARTHAS VINEYARD INNER HARBOR AT EDGARTOWN, MASS.

MIDDLE GROUND SHOAL

Scale

100 0 500 1000 1500 2000 FEET

Based on maps made 1889, '94 under direction of the Newport U.S. Engineer office. Reduced and drawn by P. Brosig.

△ • △ SURVEY STATIONS

——— SHORE LINE AT M.L.W.

·····12····· CONTOURS AT DEPTHS (FT.) AT M.L.W.

B.M. BENCHMARK. 5,206 FT. ABOVE M.L.W.

MEAN RISE AND FALL OF TIDE IS ABOUT 2.0 FT.

DREDGING TO 10.0 FT. DEPTH AT M.L.W.

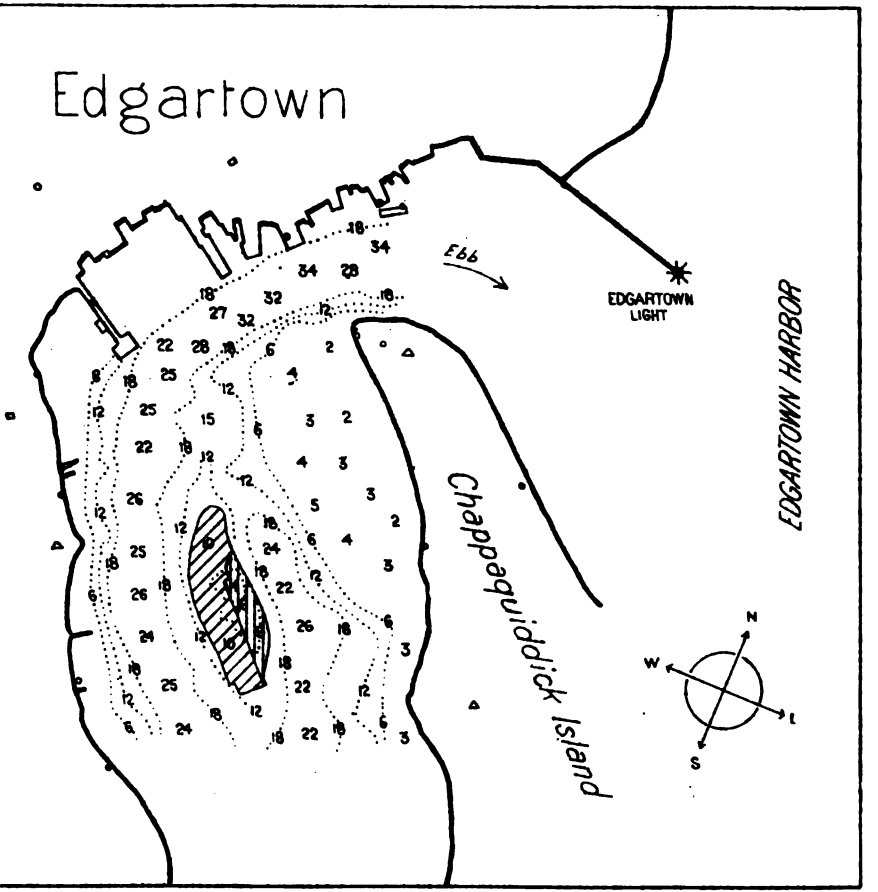
PRIOR TO JUNE 30. 1894,

AREA TO BE DREDGED

Newport, R.I. *July 1895*

Official *Wm. W. Harts*

1st. Lieut., Corps of Engineers, U.S.A.



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Abstract of proposals opened March 20, 1895, at Newport, R. I., by Capt. W. H. Bixby, U. S. Engineers, for dredging in the harbor at Edgartown, Marthas Vineyard, Mass.

[Quantity required, about $1,200 worth of work.]

No.	Name and address of bidder.	Price per cubic yard—	
		On this work alone.	In connection with other work.
		Cents.	*Cents.*
1	Hartford Dredging Co., Hartford, Conn	29	* 27.5
2	Columbia Dredging Co., Fall River, Mass		† 22.5
3	Elijah Brainard, New York		‡ 25

* With 3 other works. † With 1 other work. ‡ With 2 other works.

Contract awarded to Hartford Dredging Company at 27.5 cents.

COMMERCIAL STATISTICS.

The commerce arriving and leaving Edgartown, Marthas Vineyard, Mass., by water during the calendar year ending December 31, 1894, is estimated as follows (based mainly upon reports received from Mr. Abraham Osborn, collector of customs, Edgartown, Mass.):

Class of goods.	Exports.	Imports.	Total.	
			Value.	Tons.
Cotton and products		$35,000	$35,000	600
Tobacco		60,000	60,000	75.5
Rice		150	150	.5
Grains and forage		78,500	78,500	3,750
Vegetables and truck		10,000	10,000	55
Live stock and products	$10,200	48,500	58,700	120
Fish, oysters, etc	62,000	5,900	67,900	1,450
Naval stores		475	475	10
Lumber and products		5,300	5,300	500
Coal, minerals, and products	900	36,000	36,900	4,700
Fertilizers		1,400	1,400	70
Machinery		500	500	50
General merchandise	9,000	409,000	418,000	5,650
Sundries, passengers, etc	15,000	100,000	115,000	2,300
Total	97,100	790,725	887,825	19,331

Gain over last year, about 1,100 tons; new transportation companies established during the year, none.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam:			
Freight and passenger	500	9	345
Fishing	25	11	120
Tugs	95	9.5	80
Pleasure boats	150	8	100
Sail:			
Freight	500	12	150
Fishing boats	11,000	3.5	9
Pleasure boats, large	500	7	20
Pleasure boats, small	2,700	3	4

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C 4.

IMPROVEMENT OF VINEYARD HAVEN HARBOR, MASSACHUSETTS.

Vineyard Haven is a deep indentation in the northern shore of the island of Marthas Vineyard, on the southern side of Vineyard Sound. It is triangular in form and faces the northeast. The width of the mouth of the harbor, or the distance between the points of land on the east and west sides of the entrance known as East Chop and West Chop, is about 1¼ miles; and from a line connecting the chops to the narrow southerly end of the harbor, at which is situated the town of Vineyard Haven, the distance is about 1¾ miles. The entire area of the harbor between the shore lines is about 949 acres, of which some 657 acres have a depth of not less than 15 feet. The mean rise and fall of the tide is 1.7 feet.

Original condition.—At the mouth of the harbor the wearing away of the chops by the action of the waves in storms had been noted for many years. The former site of a light-house on West Chop had entirely disappeared. The débris was carried by the current into the harbor, where it formed shoals, which were gradually impairing the anchorage capacity, especially in the upper part of the harbor. (For map of harbor see p. 580 of Annual Report of 1887.)

Plan of improvement.—The present approved project, that of 1887, as modified in 1889, provides for the protection of the "chops" (or headlands) from erosion, and the intervening harbor from being filled by the eroded material; the whole to be done by means of stone sea walls and jetties, to be built along the beach in front of the bluffs at both headlands, all at a total cost estimated in 1889 at $60,000.

A description of the work may be found at page 594, Annual Report of the Chief of Engineers for 1882, page 577 of 1887, and page 612 of 1889, and a map of the same at page 812 of 1893.

Appropriations.—Upon the present project appropriations have been made as follows: 1888, $25,000; 1890, $10,000; 1892, $7,500; 1894, $7,500. Total up to June 30, 1895, $50,000.

Amount expended and results to June 30, 1894.—The total amount expended on present project (including $457.12 outstanding liabilities) up to June 30, 1894, was $40,852.63, by which there had been built a sea wall of 575 feet length and a jetty of 50 feet length at the East Chop, and a sea wall of 880 feet length, 3 jetties of 150, 135, and 280 feet length, a wharf, and a short breakwater of 60 feet length at the West Chop, completing over two-thirds of the needed work.

Operations during the past fiscal year.—Value of United States plant, $3,075. Including $2.50 of outstanding liabilities on June 30, 1895, the expenses of the year were $1,832.27.

Active field work was resumed in July and continued until August, by which 300 tons of stone were towed to the place of work, and out of this (and 146 tons of stone on hand at the end of last season's work) 331 tons large stone and 115 tons small stone were placed in position in about 186 feet length in the sea walls and jetties at the East Chop, making this wall of about 960 feet total length, and also a small amount of stone displaced from the walls and jetties was replaced on both the East and West Chops, completing all stone work under the 1892 appropriations. In August a project was submitted and approved for the expenditure of the new appropriation of August 17, 1894, the main stone work to be done by contract, but other work to be done by hired labor, and the purchase of materials in open market. Preparations are being made for resumption and completion of work.

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PROGRESS MAP FOR 1895
VINEYARD HAVEN HARBOR, MASS.
FROM 1. JULY 1894 TO 30. JUNE 1895

HARBOR ENTRANCE
East Chop & West Chop
SHORE-PROTECTION

SCALE

100 0 200 400 600 800 1000 FEET

Based on map made 1892 under direction of Capt. W. H. Bixby, Corps of Engrs. U.S.A. by J. H. Rosiock. Reduced & drawn by P. Brosig.

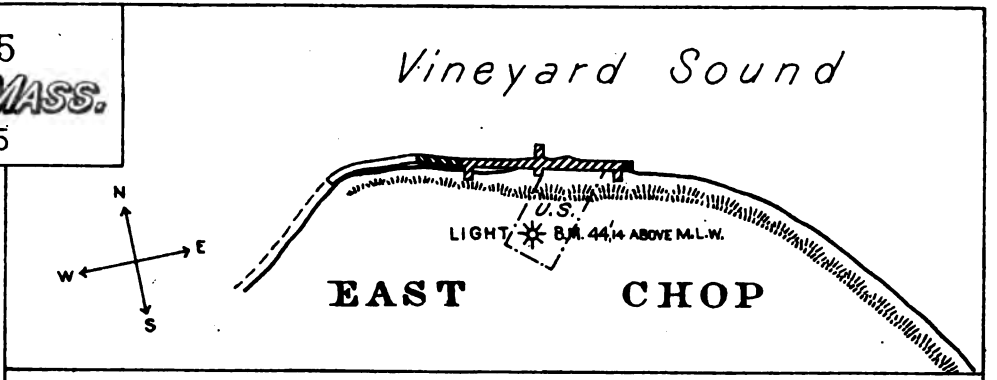
- SHORE LINE AT M.L.W.
- SHORE LINE AT M.H.W.
- BLUFF
- B.M. BENCHMARKS
- MEAN RISE AND FALL OF TIDE IS ABOUT 1.7 FT.
- JETTIES AND WALLS, PROPOSED
- WORK DONE PRIOR TO JUNE 30. 1894
- WORK DONE DURING FISCAL YEAR 1894-'95

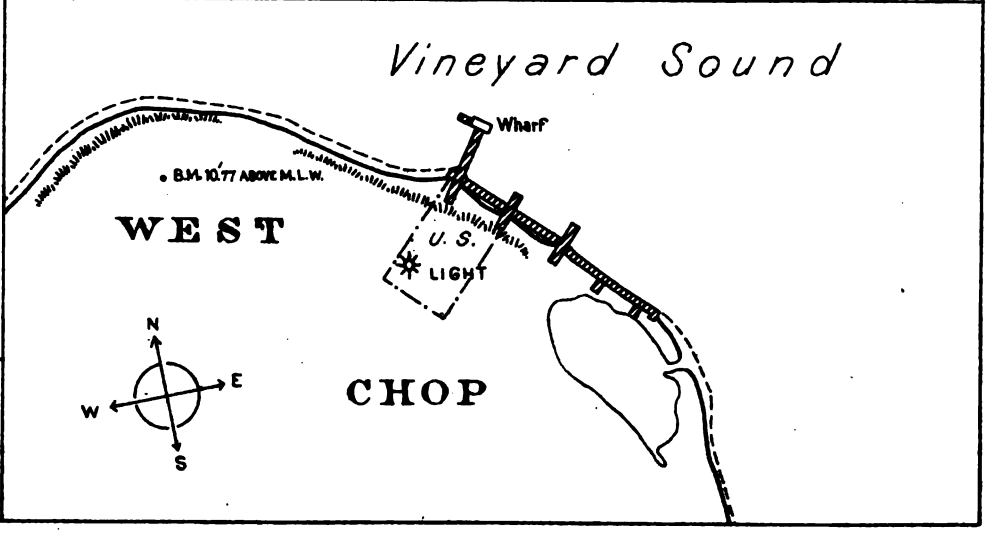
Newport, R.I. July 1895

Respectfully submitted

Wm. W. Harts

1st Lieut., Corps of Engineers, U.S.A.





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This work was in the local charge of Mr. Edward Parrish as superintendent, with Mr. S. B. Pendleton as inspector.

Work required to complete the existing project.—The work required to complete the existing project is the completion of these systems of jetties and sea walls for land protection at both chops.

Operations contemplated for the fiscal year ending June 30, 1896.—It is proposed to resume field work and to complete the project.

Vineyard Haven is in the Edgartown collection district. Edgartown is the nearest port of entry. The amount of revenue collected at Edgartown in the last calendar year was $365.57. The nearest light-houses are those on East and West Chops. The nearest fortification is the fort at Clarks Point, New Bedford, Mass.

Money statement.

July 1, 1894, balance unexpended	$2,104.49
Amount appropriated by act of August 17, 1894	7,500.00
	9,604.49
June 30, 1895, amount expended during fiscal year	2,286.89
July 1, 1895, balance unexpended	7,317.60
July 1, 1895, outstanding liabilities	2.50
July 1, 1895, balance available	7,315.10
Amount (estimated) required for completion of existing project	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS.

The commerce arriving and leaving Vineyard Haven Harbor, Massachusetts, by water during the calendar year ending December 31, 1894, is estimated as follows (based mainly upon reports received from Mr. W. W. Neifert, weather bureau, Vineyard Haven, Mass.):

Class of goods.	Exports.	Imports.	Total.	
			Value.	Tons.
Cotton and products		$10,000	$10,000	40
Tobacco		10,000	10,000	15
Rice		4,000	4,000	45
Grains and forage		15,000	15,000	800
Vegetables and truck		5,000	5,000	15
Live stock and products	$3,500	40,000	43,500	200
Fish, oysters, etc	20,000	20,000	40,000	500
Naval stores		1,200	1,200	60
Lumber and products		50,500	50,500	350
Coal, minerals, and products		156,000	156,000	52,000
Fertilizers		2,000	2,000	50
General merchandise		600,000	600,000	5,000
Total	23,500	913,700	937,200	59,075

Gain over last year, nothing special; new transportation companies established during the year, none.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam:			
Freight and passenger	1,500	10	600
Freight mainly	200	16	1,000
Passenger mainly	50	12	900
Fishing	10	10	200
Tugs	500	11	100
Pleasure boats	200	9	200
Sail:			
Freight	7,000	15	500
Fishing boats	300	10	150
Pleasure boats, large	500	10	100
Pleasure boats, small	200	5	10

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C 5.

HARBOR OF REFUGE AT WOODS HOLE, MASSACHUSETTS.

The harbor of Woods Hole lies near the strait of the same name between Buzzards Bay and Vineyard Sound. This strait separates the mainland of Cape Cod, Massachusetts, from Naushon and neighboring islands. The harbor consists of two parts, Great Harbor and Little Harbor. The present work of improvement, consisting chiefly of repairs to the wharves of the United States Fish Commission, is located in Great Harbor.

The rise and fall of the tide is about 2 feet.

Original condition.—Before the improvement the site of the present work was a submerged point of land extending from the shore of the harbor. A plan of the pier and wharf is to be found at page 598, Annual Report of the Chief of Engineers for 1884.

Plan of improvement.—The project approved in 1883, and extended in 1884 and 1886, provided for the construction of a stone pier and wooden wharf in Woods Hole Harbor, mainly for the use of the United States Fish Commission and incidentally for the use of the other branches of the public service; all at a total cost of $91,000, all of which was both appropriated and expended prior to 1889. The appropriation of 1895 (sundry civil act) adds $5,000 for the repair of this pier and wharf.

Appropriations.—Upon the present approved project appropriations have been made as follows: 1882, $52,000; 1884, $25,000; 1886, $14,500; 1895, $5,000. Total up to June 30, 1895, $96,500.

Amount expended and results up to June 30, 1895.—The total amount expended on the present project (including $2,347.69 outstanding liabilities) up to June 30, 1895, was $94,798.82, by which the projected wharves and basins had been completed in 1888, and important repairs to this wharf had been made, including repairs to the sea walls.

Operations during the past fiscal year.—Including $2,347.69 of outstanding liabilities on June 30, 1895, the expenses of the year were $3,298.82.

A project was submitted and approved for the expenditure of the new appropriation ($5,000) of March 2, 1895; all work to be done by hired labor and the purchase of materials in open market. An examination had been made in March to determine approximately the amount of needed repairs. The work of repair to the wharf and sea wall was commenced in April, and was still in progress at the close of the year, the sea wall on the east side of the basin being repaired, the old planking being removed from the coal and west wharves, and about one-half of the new planking being put in place.

This work was in the local charge of Mr. E. Parrish as assistant engineer, with Mr. Theodore McMahan and Mr. D. B. Higgins as overseers.

Work required to complete the existing project.—The work required to complete the existing project is the completion of repairs to the wharves and sea walls.

Operations contemplated for the fiscal year ending June 30, 1896.—Nothing, except the completion of the repairs.

Woods Hole is in the Barnstable collection district. New Bedford is the nearest port of entry. The amount of revenue collected in the last fiscal year was, at Barnstable, $438.69, and at New Bedford, $49,333.56. The nearest light-house is Nobska Light. The nearest fortification is the fort at Clarks Point, New Bedford, Mass.

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PROGRESS MAP FOR 1895
HARBOR OF REFUGE
AT
WOODS HOLL, MASS.
FROM 1. JULY 1894 TO 30. JUNE 1895

REPAIR OF PIER & WHARF

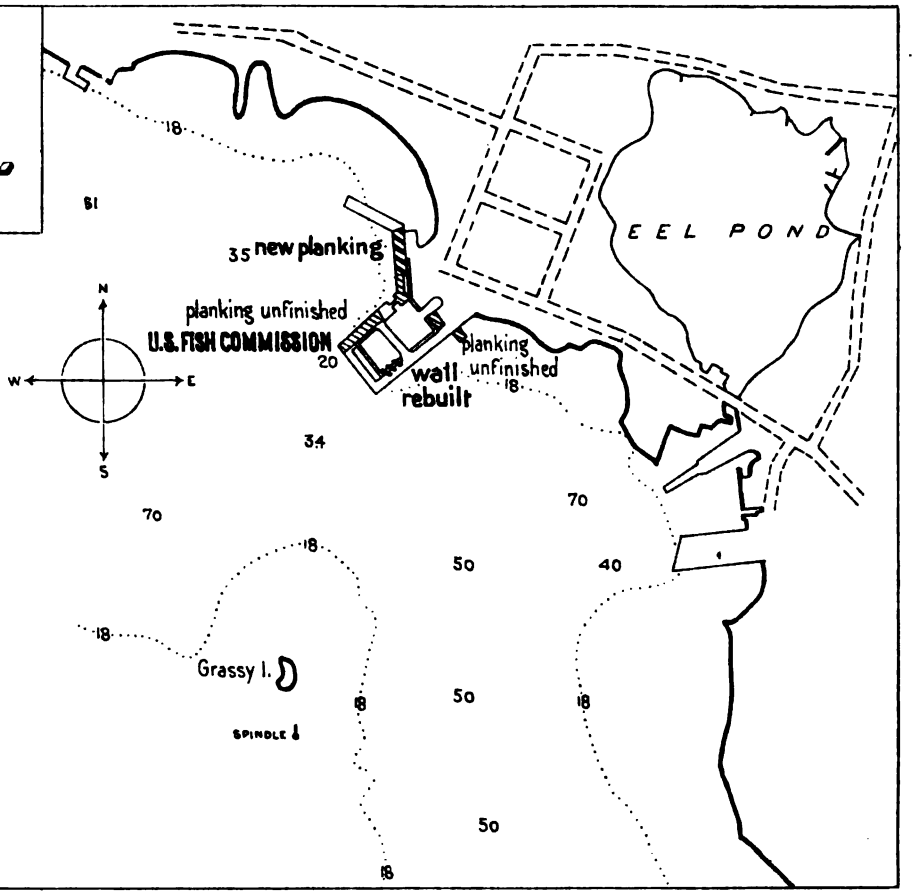
Scale

100 0 200 400 600 800 1000 FT.

Based on Coast Survey Chart.

— WORK DONE —

DURING FISCAL YEAR 1894/95.



Newport, R.I. July 1895

Respectfully submitted

Wm W. Harts

1st Lieut., Corps of Engineers, U.S.A.

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Money statement.

Amount appropriated by sundry civil act approved March 2, 1895	$5,000.00
June 30, 1895, amount expended during fiscal year	951.13
July 1, 1895, balance unexpended	4,048.87
July 1, 1895, outstanding liabilities	2,347.69
July 1, 1895, balance available	1,701.18

COMMERCIAL STATISTICS.

The commerce arriving and leaving Woods Hole, Mass., by water during the calendar year ending December 31, 1894, is estimated as follows (based mainly upon reports received from Walter D. Luscombe, Woods Hole, Mass.):

Class of goods.	Total imports.	
	Value.	Tons.
Grains and forage	$59,750	2,275
Vegetables and truck	425	4
Live stock and products	19,100	123
Fish, oysters, etc	12,600	158
Naval stores	90	5
Lumber and products	34,925	2,170
Coal, minerals, and products	10,750	2,025
Fertilizers	3,000	100
General merchandise	19,350	1,115
Total	159,990	7,975

Gain over last year, nothing special; new transportation companies established during the year, none.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam:			
Freight and passenger	4	10	900
Freight mainly	1	7	20
Fishing	2	8	30
Tugs	20	10	350
Pleasure boats	25	10	100
Sail:			
Freight	50	8	150
Fishing boats	100	8	50
Pleasure boats, large	35	4	15
Pleasure boats, small	20	3	5

C 6.

IMPROVEMENT OF WAREHAM HARBOR, MASSACHUSETTS.

This harbor is an estuary at the head of Buzzards Bay. The object of the improvement is to deepen and widen the channel leading from Buzzards Bay to Wareham, the industries of which town (and of several towns in the vicinity with which it is connected by rail) are chiefly the manufacture of iron, for which heavy materials and supplies must be transported by water. The commerce of Wareham is carried on in sailing vessels, which require a wide channel suited to beating across the wind.

Another object of the improvement is the raising of Long Beach, over which the sands from the bay were washed into the harbor. The mean rise and fall of the tide is 4 feet.

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Original condition.—Before improvement the ruling depth in the harbor was about 7 feet at mean low water, and the channel was narrow and very crooked. Long Beach, a narrow sand spit at the mouth of the harbor, was washed and abraded by the waves and currents at high water, and the material was carried into and shoaled the channel inside.

Between 1871 and 1875 $40,000 was appropriated to obtain a channel depth of 10 feet in the lower harbor and 9 feet in the upper harbor, and to partially protect Long Beach by brush and stone work. This work was finished in 1876.

At the adoption of the present project the headland of Long Beach was wearing off and the adjacent parts of the channel and harbor were shoaling; the channel depth was limited to 9 feet at low water, this channel being narrow and crooked.

Plan of improvement.—The present approved project, that of 1880, provides for the deepening and widening of the channel from Buzzards Bay to Wareham so as to obtain 9 feet depth at low water over 250 feet width from the entrance up to Barneys Point, thence the same depth over 350 feet width up to the lower wharves of the city, and thence the same depth and from 200 to 100 feet width opposite the city front; and for the raising and protecting of Long Beach (the eastern headland of the entrance) so as to prevent the erosion of this beach and the shoaling of the adjacent parts of the channel and harbor; all at a total cost estimated in 1887 at $56,236.

A plan of the works may be found at page 586, Annual Report of the Chief of Engineers for 1885, and page 814 of 1893; and further information at page 553 of 1881, and page 80, Part I of 1882.

Appropriations.—Upon the present project appropriations have been made as follows: 1881, $10,000; 1882, $5,000; 1884, $10,000; 1886, $15,000; 1888, $4,000; 1890, $5,000; 1892, $7,236. Total up to June 30, 1895, $56,236.

Amount expended and results to June 30, 1894.—The total amount expended on the present project (including $66.74 outstanding liabilities) up to June 30, 1894, was $55,827.96, by which the channel had been deepened to over three-quarters width and full depth of 9 feet in its upper portion, and to over half width in its lower portions; and the sand spit had been partly protected by catch-sand fences and brush and stone work.

Operations during the past fiscal year.—Value of United States plant, $4,897. Including $3.33 of outstanding liabilities on June 30, 1895, the expenses of the year were $236.31.

In August a project, as provided for by the act of August 17, 1894, was approved for a resurvey of the harbor, to be paid out of the remaining balance of past appropriations.

Further dredging awaits further appropriations.

This work was in local charge of Mr. J. H. Rostock as assistant engineer.

Work required to complete the existing project.—The work required to complete the existing project is the excavation of the channel to its full width and depth at its upper and lower ends.

Operations contemplated for the fiscal year ending June 30, 1896.—It is proposed to apply the balance of funds on hand and the next appropriation toward the completion of the channel.

Wareham is in the New Bedford collection district. New Bedford is the nearest port of entry. The amount of revenue collected at New Bedford in the last calendar year was $49,333.56. The nearest light-houses are Bird Island and Wing Neck lights. The nearest fortification is the fort at Clarks Point, New Bedford, Mass.

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Money statement.

July 1, 1894, balance unexpended	$474.78
June 30, 1895, amount expended during fiscal year	205.97
July 1, 1895, balance unexpended	268.81
July 1, 1895, outstanding liabilities	3.33
July 1, 1895, balance available	265.48

COMMERCIAL STATISTICS.

The commerce arriving and leaving Wareham, Mass., by water during the calendar year ending December 31, 1894, is estimated as follows (based mainly upon reports received from Mr. Alden Besse, Wareham, Mass.):

Class of goods.	Exports.	Imports.	Total.	
			Value.	Tons.
Grains and forage	$65,000	$205,000	$270,000	12,500
Vegetables and truck	190,000	10,000	200,000	2,250
Live stock and products	1,000	39,000	40,000	380
Fish, oysters, etc	20,000	7,000	27,000	7,000
Lumber and products	4,000	60,000	64,000	2,800
Coal, minerals, and products	9,000	370,000	379,000	48,000
Machinery, manufactured iron, steel, and hardware	560,000	20,000	580,000	15,000
General merchandise	38,000	190,000	228,000	1,500
Sundries	5,000	30,000	35,000	350
Total	892,000	931,000	1,823,000	89,780

Compared with last year, there is a loss of about 28,000 tons.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam:			
Passenger mainly	30	8	300
Tugs	40	10	50
Sail:			
Freight	92	11	250
Pleasure boats	300		
Barges	14	10	500

C 7.

IMPROVEMENT OF NEW BEDFORD HARBOR, MASSACHUSETTS.

New Bedford Harbor is an estuary of Buzzards Bay and is the port of the cities of New Bedford and Fairhaven, Mass. New Bedford is an important port of entry. It is largely interested in manufactures, those of cotton predominating, and has an extensive commerce in addition to its whale fisheries. The population of New Bedford and Fairhaven in 1890 was about 45,000.

The object of the improvement is to provide a channel 18 feet deep at mean low water.

The mean rise and fall of the tide is about 4.2 feet.

Original condition.—Before improvement the channel had a ruling depth of about 12½ feet at mean low water.

As early as 1839 some little dredging was done for the improvement of the harbor. The increase of depth obtained, however, was only 2

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feet, and the cut but 30 feet wide. A survey of the harbor was made in 1852, but a definite project for its improvement was not made until 1874. The project provided for a channel 200 feet wide and 15 feet deep at mean low water from the deep water just above Palmer Island to the wharves at New Bedford. This project was modified in 1877, increasing the width of channel to 300 feet, and by means of appropriations made in 1875–76, amounting to $20,000, this project was completed in 1877. Since that time vessels of larger draft have been employed in the harbor, and vessels of 15 feet draft not only now touch the bottom of this channel, but in the channel below Palmer Island, at points not included in the former improvement.

At the adoption of the present project the channel was winding and only about 15 feet deep.

Plan of improvement.—The present approved project, that of 1887, provides for the deepening, widening, and straightening of the channel from Buzzards Bay to New Bedford, so as to obtain 18 feet depth at low water over 200 feet width and over its entire length; all at a total cost estimated in 1887 at $35,000.

A description of the works may be found at page 514, Annual Report of the Chief of Engineers for 1888, and a plan of the same in House Ex. Doc. No. 86, Fiftieth Congress, first session, and at page 816, Annual Report of 1893.

Appropriations.—Upon the present project appropriations have been made as follows: In 1888, $10,000; 1890, $10,000; 1892, $7,500; 1894, $7,500. Total, up to June 30, 1895, $35,000.

Amount expended and results to June 30, 1894.—The total amount expended on the present project (including $51.80 outstanding liabilities), up to June 30, 1894, was $26,871.24, by which the uppermost reach, that above Palmer Island, had been completed to full dimensions, the upper half of the remaining reaches had been dredged to two-thirds width and full depth, and a slightly crooked channel of full dimensions existed over the remaining half, wandering a little from the projected channel.

Operations during the past fiscal year.—Value of United States plant, $2,998. Including $197.07, outstanding liabilities on June 30, 1895, the expenses of the year were $747.30.

In August a project was approved for the expenditure of the new appropriation of August 17, 1894; the main work of dredging to be done by contract, but other work to be done by hired labor and the purchase of materials in open market. Under this appropriation bids for dredging were received, and contract for about $5,000 worth of work was entered into with the Hartford Dredging Company of Hartford, Conn., under date of April 13, approved by the Chief of Engineers April 30, 1895, at 17 cents per cubic yard; work to be commenced by June 1, 1895 (later extended until September 10, 1895), and completed (in connection with Hyannis, Canapitsit, and Edgartown) by September 1, 1896. A minor survey was in progress at the close of the year for use in locating and estimating cost of future work.

This work was in the local charge of Mr. E. Parrish as assistant engineer, and the survey was under Mr. J. H. Rostock as assistant engineer.

Work required to complete the existing project.—The work required to complete the existing project is the widening of the channel from Palmer Island to the 11-foot bank, and the removal of a few shoal spots between the 11-foot bank and the Butler Flats, the southern end of the projected channel.

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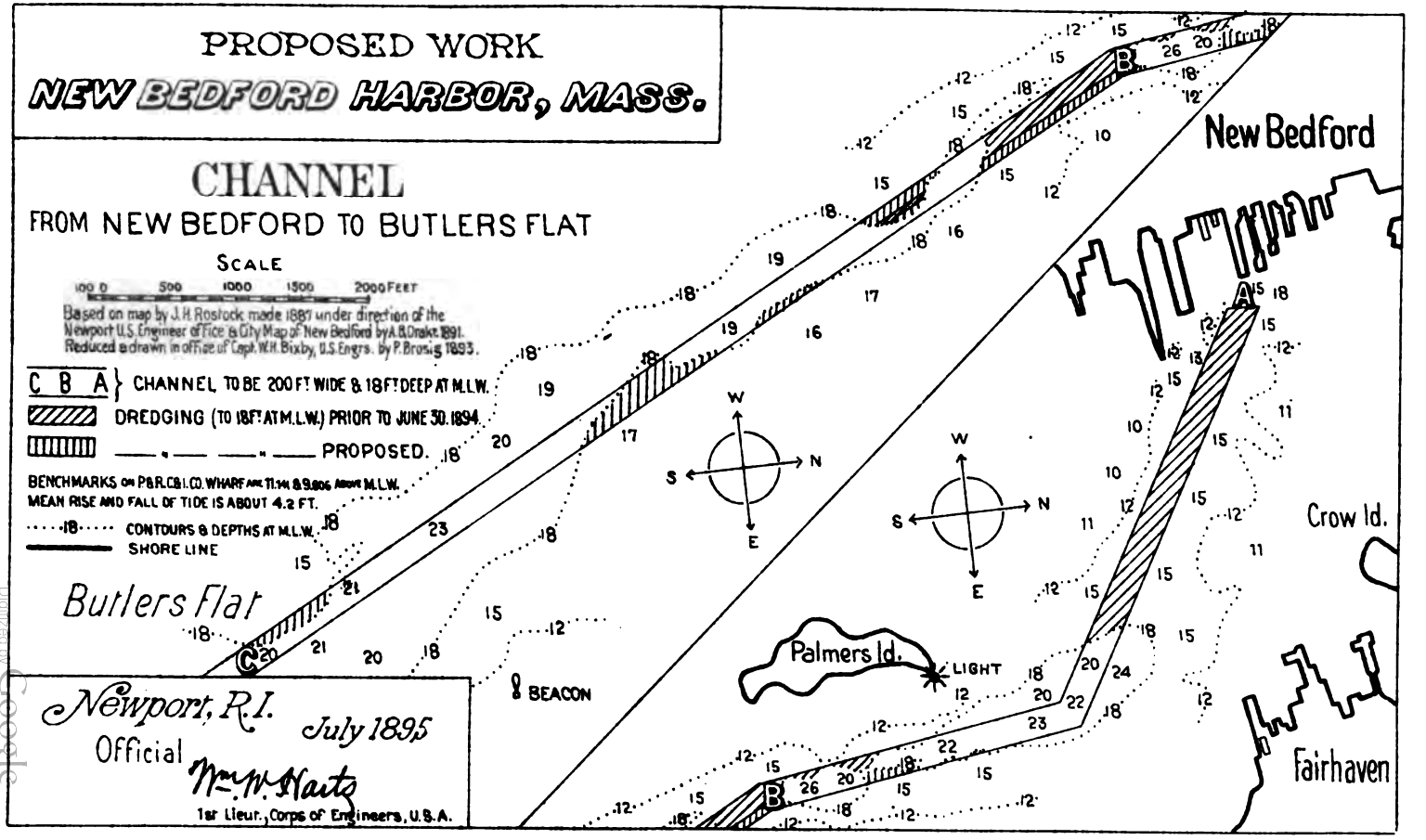
PROPOSED WORK
NEW BEDFORD HARBOR, MASS.
CHANNEL
FROM NEW BEDFORD TO BUTLERS FLAT
SCALE
100 0 500 1000 1500 2000 FEET
Based on map by J.H. Rostock, made 1887 under direction of the Newport U.S. Engineer Office & City Map of New Bedford by A.B. Drake 1891. Reduced & drawn in office of Capt. W.H. Bixby, U.S. Engrs. by P. Brosig 1893.
C B A } CHANNEL TO BE 200 FT WIDE & 18 FT DEEP AT M.L.W.
DREDGING (TO 18FT AT M.L.W.) PRIOR TO JUNE 30. 1894.
PROPOSED.
BENCHMARKS ON P&R.C&I.CO. WHARF ARE 11.141 & 9.806 ABOVE M.L.W.
MEAN RISE AND FALL OF TIDE IS ABOUT 4.2 FT.
18 CONTOURS & DEPTHS AT M.L.W.
SHORE LINE
Butlers Flat
New Bedford
Crow Id.
Fairhaven
Palmers Id.
LIGHT
BEACON
W
S
N
E
Newport, R.I. July 1895
Official
1st Lieut., Corps of Engineers, U.S.A.

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Operations contemplated for the fiscal year ending June 30, 1896.—It is proposed to complete the project.

New Bedford Harbor is in the New Bedford collection district, and is a port of entry. The amount of revenue collected in the last calendar year was $49,333.56. The nearest light-houses are Clarks Point Light and the lights in New Bedford Harbor The nearest fortification is fort at Clarks Point, Mass.

Money statement.

July 1, 1894, balance unexpended		$630.56
Amount appropriated by act of August 17, 1894		7,500.00
		8,180.56
June 30, 1895, amount expended during fiscal year		602.03
July 1, 1895, balance unexpended		7,578.53
July 1, 1895, outstanding liabilities	$197.07	
July 1, 1895, amount covered by uncompleted contracts	5,000.00	
		5,197.07
July 1, 1895, balance available		2,381.46

Abstract of proposals opened March 20, 1895, at Newport, R. I., by Capt. W. H. Bixby, U. S. Engineers, for dredging in the harbor at New Bedford, Mass.

[Quantity required, about $5,000 worth of work.]

No.	Name and address of bidder.	Price per cubic yard—	
		On this work alone.	In connection with other work.
		Cents.	*Cents.*
1	Hartford Dredging Co., Hartford, Conn	17.3	*17
2	Columbia Dredging Co., Fall River, Mass		†34
3	Elijah Brainard, New York		‡30

* With 3 other works. † With 1 other work. ‡ With 2 other works.

Contract awarded to Hartford Dredging Company at 17 cents.

COMMERCIAL STATISTICS.

The commerce arriving at and leaving New Bedford, Mass., by water during the calendar year ending December 31, 1894, is estimated as follows (based mainly upon reports received from Mr. Z. W. Pearce, collector of customs, and Mr. John Mayhew, of New Bedford, Mass.):

Class of goods.	Exports.	Imports.	Total.	
			Value.	Tons.
Cotton and products	$2,875,000	$1,412,500	$4,287,500	10,500
Tobacco		3,000	3,000	14
Grains and forage		418,000	418,000	24,400
Vegetables and truck		100,200	100,200	2,630
Live stock and products		18,000	18,000	100
Fish, oysters, etc	158,000	227,800	385,800	2,378
Naval stores		54,250	54,250	1,275
Lumber and products		161,000	161,000	21,400
Coal, minerals, and products	14,000	1,821,000	1,835,000	459,000
General merchandise	3,600,000	8,181,000	11,781,000	59,515
Total	6,647,000	12,396,750	19,043,750	581,212

Gain over last year about $2,000,000; new transportation companies established during the year, none.

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The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam:			
Freight and passenger	700	8	560
Freight mainly	450	17	1,000
Passenger mainly	500	8	60
Tugs	650	8	50
Pleasure boats	250		
Sail:			
Freight	1,650	13	800
Fishing boats	500	5	10
Pleasure boats, large	400		
Pleasure boats, small	1,000		

C 8.

IMPROVEMENT OF CANAPITSIT CHANNEL, MASSACHUSETTS.

This waterway lies about 20 miles south of New Bedford, running between the islands of Cuttyhunk and Nashawena, and connecting the waters of Vineyard Sound and Buzzards Bay.

The object of the improvement is to make this channel safe for the use of light-draft sailboats, and also especially of the surfboats belonging to the life-saving station of this dangerous locality.

Original condition.—Before improvement the sand shoals, and especially the numerous bowlders, made this passage specially dangerous to the life-saving station boats and other shallow-draft row and sail boats.

Plan of improvement.—The present approved project, that of 1891, provides for the widening and deepening of the present channel from Vineyard Sound to the ocean between the islands of Nashawena and Cuttyhunk, Massachusetts, so as to secure a depth of 6 feet at low water, with a least width of 150 feet over its entire length, all at a total cost estimated in 1893 at $9,800.

A description of the work may be found at page 645, Annual Report of the Chief of Engineers for 1892, and a plan of the same in House Ex. Doc. No. 59, Fifty-second Congress, first session; and at page 820 of Annual Report of 1893; and further special information on page 820, Annual Report of 1893.

Appropriations.—Upon the present project two appropriations have been made, that of 1892 for $4,800, and 1894 for $5,000. Total up to June 30, 1895, $9,800.

Amount expended and results to June 30, 1894.—The total amount expended on the present project (including $41.01 of outstanding liabilities) up to June 30, 1894, was $4,721.31; by which a channel of 66 feet width and about 5 feet depth at low water was cut entirely through from Buzzards Bay to Vineyard Sound.

Operations during the past fiscal year.—Value of United States plant, $676. Including $15.37 outstanding liabilities on June 30, 1895, the expenses of the year were $488.10.

In August a project was approved for the expenditure of the new appropriation of August 17, 1894, the main work of dredging to be done by contract, but other work to be done by hired labor and the purchase of materials in open market. Under this appropriation, bids for dredging were received and contract for about $3,500 worth of work was entered into with the Hartford Dredging Company, of Hartford, Conn., under date of April 13, approved by the Chief of Engineers

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PROPOSED WORK
CANAPITSIT CHANNEL, MASS.

CANAPITSIT CHANNEL
between
CUTTYHUNK & NASHAWENA ISLANDS
connecting
BUZZARDS BAY WITH VINEYARD SOUND

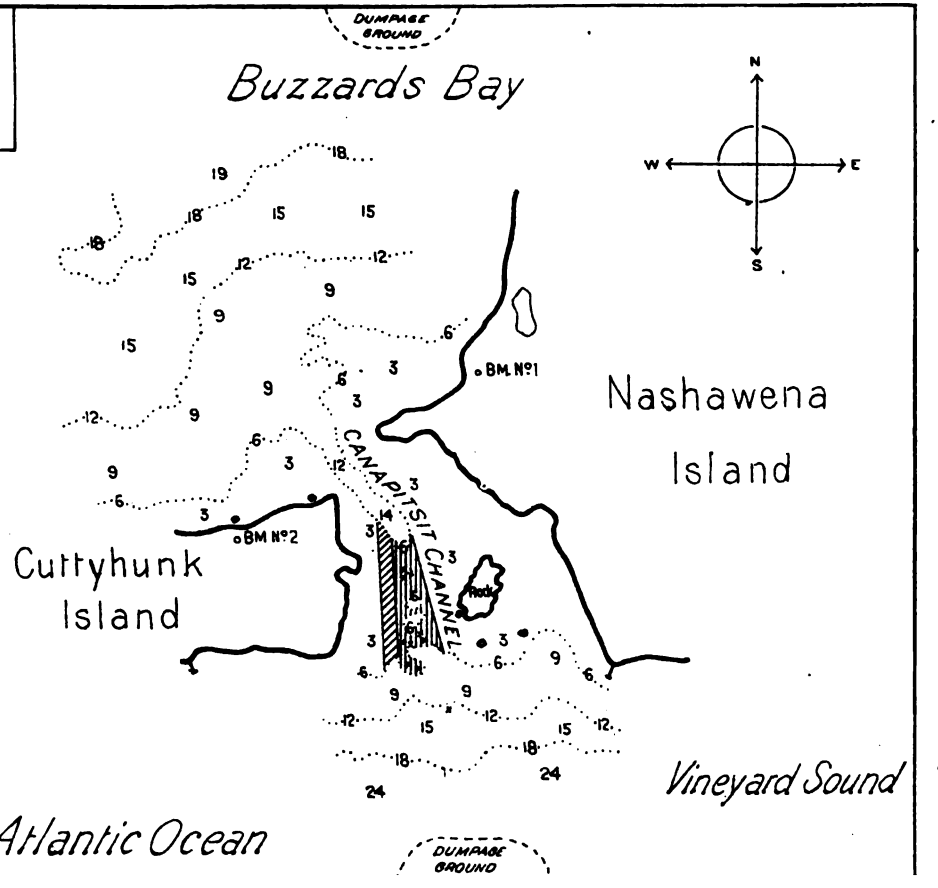
SCALE

100 0 500 1000 1500 FT.

Original map made by J.H. Rostock, 1891.
Reduced & drawn in office of Captain W.H. Bixby, Corps of Engrs U.S.A. by P. Brosig.

SHORE LINE AT M.L.W.
12 CONTOURS & DEPTHS (FEET) AT M.L.W.
B.M. BENCHMARKS No 1 = 15.56, No 2 = 10.26 ABOVE M.L.W.
× × × ROCKS
MEAN RISE & FALL OF TIDE IS ABOUT 3.6 FT.
— CHANNEL TO BE 6.0 FT. DEEP AT M.L.W. —
WORK DONE PRIOR TO 30 JUNE 1894
WORK PROPOSED

Newport, R.I. July 1895
Official
Wm. M. Hautz
1st Lieut., Corps of Engineers, U.S.A.



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April 30, 1895, at 36 cents per cubic yard; work to be commenced by June 1, 1895 (later extended to September 10, 1895), and completed (in connection with Hyannis, New Bedford, and Edgartown) by September 1, 1896.

This work has been in the local charge of Mr. J. H. Rostock as assistant engineer.

Work required to complete the existing project.—The work yet to be done is to deepen the channel throughout its entire length, the 66 feet width channel by about 1 foot, and the remaining channel of 83 feet to 283 feet width by about 2 feet.

Operations contemplated for the fiscal year ending June 30, 1896.—It is proposed to complete the project.

Money statement.

July 1, 1894, balance unexpended		$119.70
Amount appropriated by act of August 17, 1894		5,000.00
		5,119.70
June 30, 1895, amount expended during fiscal year		513.74
July 1, 1895, balance unexpended		4,605.96
July 1, 1895, outstanding liabilities	$15.37	
July 1, 1895, amount covered by uncompleted contracts	3,500.00	
		3,515.37
July 1, 1895, balance available		1,090.59

Abstract of proposals opened March 20, 1895, at Newport, R. I., by Capt. W. H. Bixby, U. S. Engineers, for dredging in Canapitsit Channel, Massachusetts.

[Quantity required, about $3,500 worth of work.]

No.	Name and address of bidder.	Price per cubic yard—	
		On this work alone.	In connection with other work.
		Cents.	Cents.
1	Hartford Dredging Co., Hartford, Conn	40	*36

* With 3 other works.

Contract awarded to Hartford Dredging Company at 36 cents.

COMMERCIAL STATISTICS.

The commerce arriving and leaving Cuttyhunk, Mass., by water during the calendar year ending December 31, 1894, is estimated as follows (based mainly upon reports received from D. P. Bosworth, Cuttyhunk, Mass.):

Class of goods.	Exports.	Imports.	Total.	
			Value.	Tons.
Tobacco		$360.00	$360.00	1
Grains and forage		1,235.50	1,235.50	47
Vegetables and truck	$295.00		295.00	10
Live stock and products	1,350.00	2,020.00	3,370.00	136
Fish, oysters, etc	60,000.00		60,000.00	1,000
Naval stores		140.00	140.00	2.5
Lumber and products		2,545.00	2,545.00	102
Coal, minerals and products		250.00	250.00	50
Fertilizers		100.00	100.00	5
General merchandise		5,675.00	5,675.00	193
Sundries	1,382.00	2,382.00	3,764.00	87
Total	63,027.00	14,707.50	77,734.50	1,633.5

Gain over last year about 925 tons, or $30,900; new transportation companies established during the year, none.

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The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
Steam:		*Feet.*	*Tons.*
Freight and passenger	150	6	60
Tugs	10	8	75
Pleasure boats	100	6	30
Sail:			
Fishing boats	1,250	4	6
Pleasure boats, large	100	7	80
Pleasure boats, small	300	3	.....

C 9.

IMPROVEMENT OF TAUNTON RIVER, MASSACHUSETTS.

This river rises in Norfolk County, Mass., and empties in Mount Hope Bay, a part of Narragansett Bay. It is about 44 miles in length.

The object of the improvement is to deepen and widen the channel so that vessels of 11 feet draft can at high water go up to the city of Taunton, which for its extensive manufactures requires large quantities of coal, iron, clay, moldings, sand, and other heavy articles. The rise and fall of the tide before improvement was 5¼ feet at Dighton and 3.4 feet at Taunton.

Original condition.—In its original condition the channel was narrow and obstructed by bowlders, and from Berkley Bridge to Taunton its depth was not, in places, more than 5 feet at mean high water. A vessel of 30 tons burden was as large as could go up to Taunton.

From 1870 to 1879 $63,000 was appropriated to secure a depth of 9 feet at high water, up to the head of navigation. This work was completed in 1879. (See p. 375, Annual Report of 1880.)

At the adoption of the present project, the channel was limited to 9 feet at high water, and was too narrow and too much obstructed by bowlders for easy navigation by the craft making use of it.

Plan of improvement.—The present approved project, that of 1880, provides for the widening and deepening of the river so as to secure a channel of at least 12 feet depth at high water, with 100 feet width from its mouth up to Berkley Bridge (above Dighton); thence 12 feet depth with 80 feet width (100 feet width at bends) up to Briggs Shoal; thence 11 feet depth with 80 feet width up to the shipyard; thence 11 feet depth with 60 feet width up to the Weir Bridge, Taunton; all at a total cost estimated in 1893 at $125,000.

A plan of the works may be found at page 606, Annual Report of the Chief of Engineers for 1884, and page 824 of the Annual Report for 1893; and a later more detailed plan in House Ex. Doc. No. 86, Fiftieth Congress, first session; and further information at page 373 of the Annual Report for 1880, page 519 of the Annual Report for 1888, and page 823 of the Annual Report for 1893.

Appropriations.—Upon the present project appropriations have been made as follows: 1880, $17,500; 1881, $25,000; 1882, $25,000; 1884, $26,500; 1890, $7,000; 1892, $7,000; 1894, $5,000. Total up to June 30, 1895, $113,000.

Amount expended and results to June 30, 1894.—The total amount expended on the present project up to June 30, 1894, was $107,998.11, by which a large part of the proposed work had been done, especially at the places most complained of by vessels using this river.

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PROPOSED WORK
TAUNTON RIVER, MASS.

PARTS OF UPPER RIVER

MILES 10.4 – 12.6 ABOVE FALL RIVER CITY

Scale

100 0 500 1000 FT.

Surveys & maps made 1871, 1887 & 1892 under direction of U.S. Engr. Office, Newport, R.I. Reduced & drawn 1895.

MEAN RISE AND FALL OF TIDE IS ABOUT 4.0 FT.

——— SHORE LINE

- - - - - - - - 11 FT. CONTOUR AT M.H.W.

11. 16 DEPTHS (FEET) " " " "

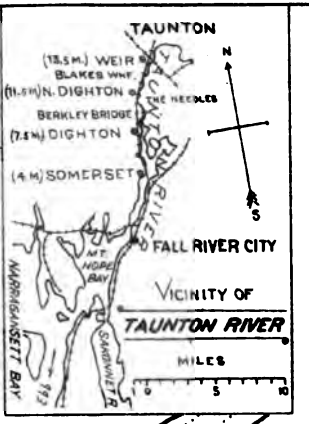
— CHANNEL TO BE 11 FT. DEEP (AT M.H.W.) & 80 FT. WIDE —

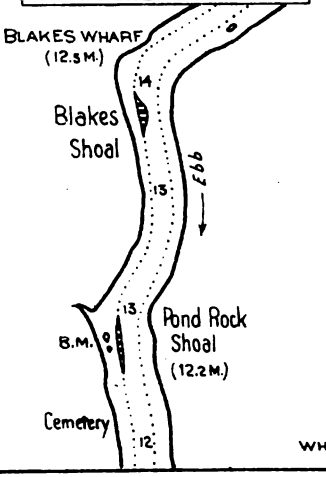
DREDGING TO BE DONE

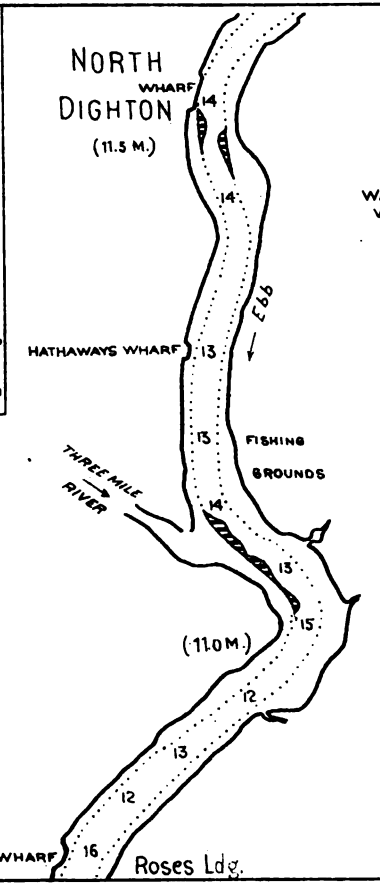
Newport, R.I. July 1895

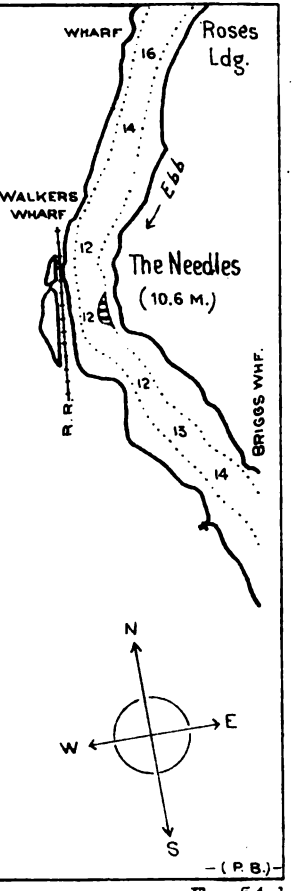
Official Wm. W. Hauts

1st. Lieut., Corps of Engineers, U.S.A.









– (P.B.) –

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Operations during the past fiscal year.—Value of United States plant, $731. Including $30.89 outstanding liabilities on June 30, 1895, the expenses of the year were $367.09.

In August a project was approved for the expenditure of the new appropriation of August 17, 1894, the main work of dredging to be done by contract, but other work to be done by hired labor and the purchase of materials in open market. Under this appropriation, bids for dredging were received and contract for about $3,000 worth of work was entered into with the Columbia Dredging Company of Fall River, Mass., under date of March 28, approved by the Chief of Engineers, April 12, 1895, at the following rates per cubic yard: 81 cents for the reach above Three Mile River; $1 at Three Mile River; and $1.35 at The Needles; work to be commenced August 1 and completed by November 1, 1895.

This work was in the local charge of Mr. Edward Parrish as assistant engineer.

Work required to complete the existing project.—There remains to complete the existing project the widening and deepening of the channel at a few points and the removal of a small amount of ledge rock.

Operations contemplated for the fiscal year ending June 30, 1896.—It is proposed to complete the project.

Taunton River is in the Fall River collection district. Fall River is the nearest port of entry. The amount of revenue collected at Fall River in the last calendar year was $27,697.81. The nearest light-house is the Borden Flat light-house. The nearest fortification is Fort Adams, Newport Harbor, Rhode Island.

Money statement.

July 1, 1894, balance unexpended		$51.89
Amount appropriated by act of August 17, 1894		5,000.00
		5,051.89
June 30, 1895, amount expended during fiscal year		336.20
July 1, 1895, balance unexpended		4,715.69
July 1, 1895, outstanding liabilities	$30.89	
July 1, 1895, amount covered by uncompleted contracts	3,000.00	
		3,030.89
July 1, 1895, balance available		1,684.80
Amount (estimated) required for completion of existing project		12,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		12,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals opened March 20, 1895, at Newport, R. I., by Capt. W. H. Bixby, U. S. Engineers, for dredging in Taunton River, Massachusetts.

[Quantity required, about $3,000 worth of work.]

No.	Name and address of bidder.	Price per cubic yard for work at—		
		Blakes Shoal, Pond Rock Shoal, and just below North Dighton Wharf.	Just below Three-mile River.	The Needles.
		Cents.		
1	Columbia Dredging Co., Fall River, Mass	81	$1.00	$1.35
2	Elijah Brainard, New York	82	1.04	1.56

Contract awarded to Columbia Dredging Company at 81 cents, $1, and $1.35, respectively.

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COMMERCIAL STATISTICS.

The commerce arriving and leaving Taunton River, Massachusetts, by water during the calendar year ending December 31, 1894, is estimated as follows (based mainly upon reports received from the Staples Coal Company, Taunton, Mass.):

Class of goods.	Exports.	Imports.	Total.	
			Value.	Tons.
Cotton and products	.....	$1,390,000	$1,390,000	8,750
Grains and forage	.....	1,100,000	1,100,000	47,300
Lumber and products	$75,000	400,000	475,000	21,000
Coal, minerals, and products	200,000	1,900,000	2,100,000	390,000
Sundries	.....	980,000	980,000	10,000
Total	275,000	6,270,000	6,545,000	477,050

Gain over last year, about 123,000 tons, or about $1,960,000; new transportation companies established during the year, none.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
Steam (tugs)	400	7	50
Sail (freight)	700	9	200
Barges	500	9	900

C 10.

IMPROVEMENT OF PAWTUCKET RIVER, RHODE ISLAND.

The navigable part of the Pawtucket (or Seekonk) River, an arm of Providence River, extends from Providence to Pawtucket, a city which in 1890 had a population of about 28,000 and extensive manufactures, depending largely on water transportation. The mean rise and fall of the tide is about 5 feet.

Original condition.—Before improvement the channel in the river was narrow and had a ruling depth of about 5 feet at mean low water.

Between 1867 and 1882 $52,000 was appropriated to dredge the channel to 75 feet width and 7 feet depth at low water. This work was completed in 1876.

At the adoption of the present project the channel was narrow and only about 7 feet deep.

Plan of improvement.—The present approved project, that of 1883, provides for the deepening of the river so as to secure a channel of at least 12 feet depth at low water, with 100 feet width from its mouth at Providence up to opposite Grant & Co.'s Wharf, at Pawtucket, and thence 12 feet depth with 40 feet width through a stone ledge for a short distance toward Pawtucket Bridge; all at a total cost estimated in 1883 at $382,500.

A plan of the works may be found at page 608, Annual Report of the Chief of Engineers for 1884, and page 830 of 1893.

Appropriations.—Upon the present project appropriations have been made as follows: 1884, $50,000; 1886, $30,000; 1888, $35,000; 1890, $30,000; 1892, $35,000; 1894, $25,000. Total up to June 30, 1895, $205,000.

Amount expended and results to June 30, 1894.—The total amount expended on the present project, including $149.28 outstanding liabilities, up to June 30, 1894, was $169,125.79, by which the shoalest places

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had been improved and about nine-tenths of the needed work done, securing a channel of about 12 feet depth with 100 feet width up to above the lower wharves of the city of Pawtucket; also ledge rock had been removed from about 5,000 square feet of ledge near the head of the river at Pawtucket, increasing the depth to at least 3.3 feet at low water over the entire ledge and about 4 feet depth over all except a small area of about 25 square feet. A minor survey had been made and a new project submitted and approved for further rock excavation in accordance with the original approved project.

Operations during the past fiscal year.—Value of United States plant, $12,392. Including $2,213.77 outstanding liabilities on June 30, 1895, the expenses of the year were $10,545.53.

Contract for removing ledge rock under the 1892 appropriation was entered into with Messrs. Rogers & Fitzpatrick, of Plattsburg, N. Y., under date of August 18, approved by the Chief of Engineers on August 22, at $7.74 per cubic yard, for about $9,000 to $10,000 worth of work; work to be commenced on or before August 25, 1894, and completed on or before February 1, 1895; the time of commencing work having been later extended to October 1, 1894, and the time of completion until September 6, 1895. Under this contract actual work was commenced on September 12, 1894, suspended in December and resumed in April, and 855 holes were drilled in the ledge, 824 blasts made, 5,761 pounds of dynamite expended, and about 422 cubic yards of material was excavated, of which 357.5 yards was dumped or otherwise disposed of, clearing the greater portion of the upper section to a depth of 8 feet at low water and the greater part of the lower section to a depth of 12 feet at low water. All drilling and blasting work under the 1892 appropriation was practically completed, leaving only a small part of the dredging to be done. In August a project was approved for the expenditure of the new appropriation of August 17, 1894, the main work of dredging and rock work to be done by contract, but other work to be done by hired labor and the purchase of materials in open market. Under the 1894 appropriation bids for ledge rock excavation were received and the contract for from 1,600 to 1,800 cubic yards entered into with Rogers & Fitzpatrick, of Plattsburg, N. Y., under date of April 4, and approved by the Chief of Engineers April 12, 1895, at $7.73 per cubic yard; work to be commenced by May 1, 1895 (later extended until June 1, 1895), and completed by January 1, 1896. Under this contract actual work was commenced May 27, 1895, and 101 holes were drilled in the ledge, 100 blasts made, and 1,460 pounds of dynamite expended (completing about nine-tenths of the drilling and blasting work under this contract), and about 65 cubic yards of material was excavated, clearing about 108 feet length of the 100 feet wide and 12 feet deep channel.

By Department letter of March 7 $2,500 was authorized to be expended for extra dredging at the Central or Red Bridge while the said bridge is being rebuilt by the city of Providence, and an agreement was made with E. Brainard, of New York, to do this work at 45 cents and 50 cents per cubic yard, measured in scows, according to the place of dumpage. Under this agreement work was commenced on April 3 and completed on April 13, when 3,352 cubic yards of material was removed from between the piers of the bridge, making the depth of water 20 feet at mean low water and largely increasing the waterway under the bridge.

The contract work was under the local charge of Mr. Edward Parrish as assistant engineer, with Messrs. W. K. Harrington, Theodore McMahan, George W. Reed, and John F. Parks as inspectors; the survey was under Mr. J. H. Rostock as assistant engineer.

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Work required to complete the existing project.—The work yet to be done is to straighten the channel in its lower half and to deepen the channel through the ledge to the full depth of 8 feet and width of 40 feet.

Operations contemplated for the fiscal year ending June 30, 1896.—It is proposed to apply the balance of funds on hand toward both the removal of the ledge and the straightening of the channel in its lower portions.

Pawtucket is in the collection district of Providence, and that port is the nearest port of entry. The amount of revenue collected at Providence in the last calendar year was $203,987.13. The nearest light-house is Sassafras Point Light. The nearest fortifications are Fort Adams, Newport, R. I., and the fort on Dutch Island, Rhode Island.

Money statement.

July 1, 1894, balance unexpended		$11,023.49
Amount appropriated by act of August 17, 1894		25,000.00
		36,023.49
June 30, 1895, amount expended during fiscal year		8,349.79
July 1, 1895, balance unexpended		27,673.70
July 1, 1895, outstanding liabilities	$2,213.77	
July 1, 1895, amount covered by uncompleted contracts	17,251.57	
		19,465.34
July 1, 1895, balance available		8,208.36
Amount (estimated) required for completion of existing project		177,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals opened July 31, 1894, at Newport, R. I., by Capt. W. H. Bixby, U. S. Engineers, for removal of ledge rock in the river at Pawtucket, R. I.

[Quantity required, about $9,000 to $10,000 worth of work.]

No.	Name and address of bidder.	Price per ton.
1	Rogers & Fitzpatrick, Plattsburg, N. Y.	$7.74
2	Wellington & Johnson, New York, N. Y.	14.00
3	P. Sanford Ross, Jersey City, N. J.	19.00
4	Johnson & Townsend, Somers Point, N. J.	12.20
5	Thos. A. Scott, New London, Conn.	9.90
6	Geo. W. Townsend, Boston, Mass.	9.93
7	Geo. W. Andrews, Biddeford, Me.	8.37

Contract awarded to Rogers & Fitzpatrick at $7.74.

Abstract of proposals opened March 20, 1895, at Newport, R. I., by Capt. W. H. Bixby, U. S. Engineers, for removal of ledge rock in the river at Pawtucket, R. I.

[Quantity required, about 1,600 to 1,800 cubic yards of work.]

No.	Name and address of bidder.	Price per cubic yard.
1	Rogers & Fitzpatrick, Plattsburg, N. Y.	$7.73
2	Emory R. Seward, Albany, N. Y.	8.70
3	Townsend & Johnston, Somers Point, N. J.	9.80
4	John H. Fenner, Jersey City, N. J.	12.25
5	Thomas A. Scott, New London, Conn.	10.90
6	George Willett Andrews, Biddeford, Me.	8.13

Contract awarded to Rogers & Fitzpatrick at $7.73.

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PROGRESS MAP FOR 1895

PAWTUCKET RIVER, R.I.

FROM 1. JULY 1894 TO 30. JUNE 1895

SHEET Nº 1.

DREDGING

AT RED BRIDGE, PROVIDENCE.

Scale

10 .0 50 100 150 FT.

Compiled & drawn in office of Capt W. H. Bixby
Corps of Engineers U.S.A. by P. Brosig.
Based on surveys by L. Parrish.

MEAN LOW WATER
ORIGINAL BOTTOM
BOTTOM AS DREDGED

DREDGING OF FISCAL YEAR 1894/95.

Newport, R.I. July 1895

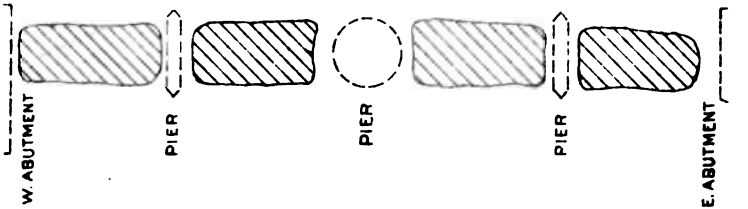
Respectfully submitted

Wm W. Harts

1st Lieut, Corps of Engineers, U.S.A.

N

PLAN



PROFILE

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PROGRESS MAP FOR 1895

PAWTUCKET RIVER, R.I.

FROM 1. JULY 1894 TO 30. JUNE 1895

SHEET N°2.

CHANNEL

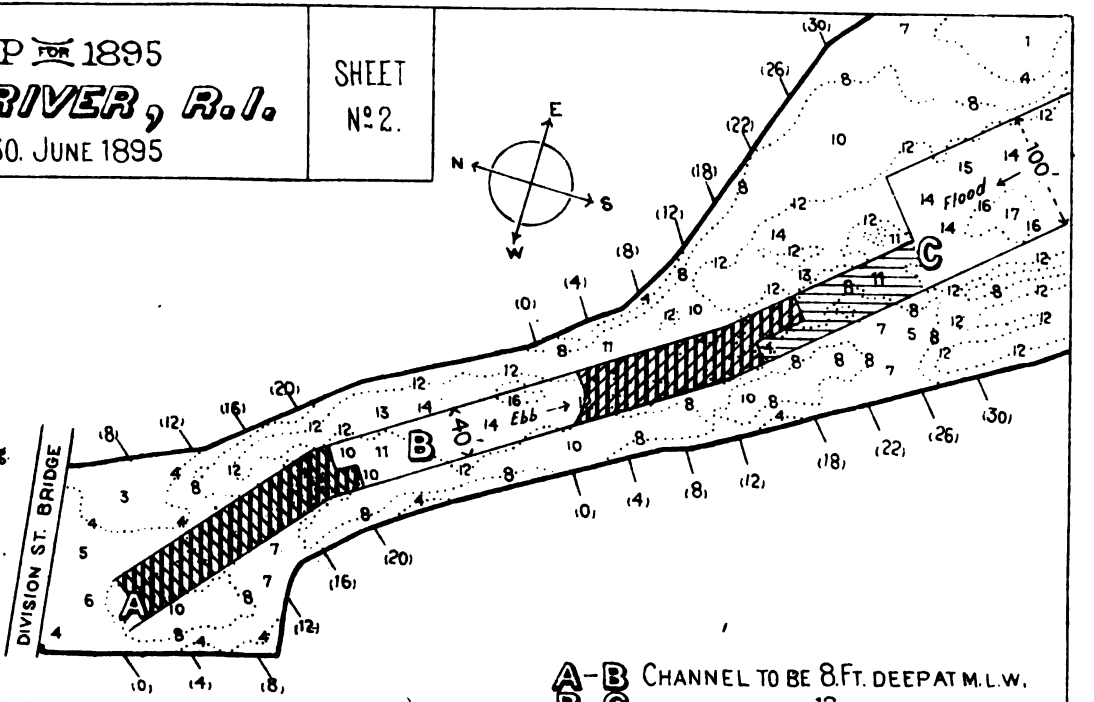
AT PAWTUCKET CITY

Scale

100 50 0 100 200 FT.

Original map made under direction of Capt. W. H. Bixby, Engrs. U.S.A. by J. H. Prestock 1895. Reduced & drawn by P. Brosig.

WORK DONE DURING FISCAL YEAR 1895.
WORK COMPLETED
PARTLY COMPLETED
PROPOSED



A–B CHANNEL TO BE 8. FT. DEEP AT M.L.W.
B–C " " " 12 " " " " " "

MEAN RISE AND FALL OF TIDE IS ABOUT 5.0 FT.

SHORE LINE AT M.L.W
4 12 16 DEPTHS (FT.) AT M.L.W.
..... CONTOURS
(0) (12) (30) RANGES

Newport, R.I. July 1895

Respectfully submitted

Wm. W. Bartz

1st. Lieut, Corps of Engineers, U.S.A.

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COMMERCIAL STATISTICS.

The commerce arriving and leaving Pawtucket River, Rhode Island, by water during the calendar year ending December 31, 1894, is estimated as follows (based mainly upon reports received from George E. Newell and others, of Pawtucket, R. I.):

Class of goods.	Exports.	Imports.	Total.	
			Value.	Tons.
Lumber and products	.....	$253,000	$253,000	12,600
Coal, minerals, and products	.....	636,000	636,000	158,000
Fertilizers	$1,000	28,000	29,000	7,000
Paving stone	.....	20,000	20,000	1,500
Sundries, cement, etc	.....	29,400	29,400	4,350
Total	1,000	966,400	967,400	183,450

Compared with last year there is a slight loss; new transportation companies established during the year, none.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	Tons.
Steam:			
Freight mainly	207	10	500
Passenger mainly	305	8	100
Tugs	455	7	80
Miscellaneous	90	5	50
Sail:			
Freight	159	10½	350
Pleasure boats, large	14	7	100

C 11.

IMPROVEMENT OF PROVIDENCE RIVER AND NARRAGANSETT BAY, RHODE ISLAND.

Providence River is an estuary of Narragansett Bay. The object of its improvement is to furnish a wide and deep channel for European and coastwise commerce from the ocean to Providence, a city which had in 1890 about 132,000 inhabitants, being twenty-fifth in size of the cities of the United States, a city largely engaged in manufactures, and also a port of entry for an extensive region of country, to which it is connected by railroads. The mean rise and fall of the tide is 4.7 feet.

Original condition.—Before the improvement of the river was commenced, in 1853, many shoals obstructed navigation, and at one point in the channel, a place called The Crook, the available low-water depth was but 4½ feet.

Between 1852 and 1873, $56,500 was appropriated to secure depths of first 9 and then 12 feet at low water. This work was finished in 1873.

At the adoption of the present project the channel was limited to 12 feet depth, and the anchorage areas were much too small and shallow for the craft seeking them.

Plan of improvement.—The present approved project, that of 1878, as modified in 1882, provides for the deepening of the river and the deepening and widening of its anchorage basins, so as to secure a channel of at least 25 feet depth at low water with 300 feet width from the deep water of Narragansett Bay up to Providence, R. I., and so as to secure from Fox to Field Point anchorage basins of 20 feet depth with 600 feet width, 18 feet depth with 725 feet width, 12 feet depth with 940 feet width, and 6 feet depth with 1,060 feet width, all at a total cost estimated in 1882 at $675,000.

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A plan of the works may be found at page 622, Annual Report of the Chief of Engineers for 1884, and page 830 of 1893; and further special information at page 235 of 1878 and page 557 of 1882.

The 25-foot channel has been laid out in straight reaches (with enlargements at the angles), with a view to their being lighted later if it should be found necessary, by range or leading lights, such as are used in similar cases in Chesapeake Bay, Delaware River, and other localities.

Appropriations.—Upon the present project appropriations have been made as follows: 1878, $50,000; 1879, $60,000; 1880, $60,000; 1881, $60,000; 1882, $125,000; 1884, $85,000; 1886, $30,000; 1888, $40,000; 1890, $50,000; 1892, $50,000; 1894, $17,500. Total up to June 30, 1895, $627,500.

Amount expended and results to June 30, 1894.—The total amount expended on the present project (including $1,102.49 outstanding liabilities) up to June 30, 1894, was $608,559.45, by which all the channel and anchorage areas had been dredged once to full widths and depths, the 25-foot depth channel, however, now needing redredging. A channel survey had been made from the mouth of Pawtucket (Seekonk) River, at Fox Point, down to and including the Pawtuxet Reach, at Sabine Point.

Operations during the past fiscal year.—Value of United States plant, $21,631. Including $77.39 outstanding liabilities on June 30, 1895, the expenses of the year were $1,634.

In August, a project was approved for the expenditure of the new appropriation of August 17, 1894; the main work of dredging to be done by contract, but other work to be done by hired labor and the purchase of materials in open market. Under this appropriation, bids for dredging were opened and the contract for about $11,000 worth of work was entered into with Messrs. R. G. & J. S. Packard, of New York, under date of March 30, approved by the Chief of Engineers, April 12, 1895, at 15 cents per cubic yard; work to be commenced by July 1 (later extended to July 15) and completed by December 1, 1895.

This work was under the local charge of Mr. E. Parrish, as assistant engineer.

Work required to complete the existing project.—There is required for the completion of the existing project the redredging of portions of the 25-foot depth channel.

Operations contemplated for the fiscal year ending June 30, 1896.—It is proposed to complete the project.

Providence River is in the collection district of Providence, which is a port of entry. The amount of revenue collected at Providence in the last calendar year was $203,987.13. The nearest light-houses are the six light-houses in Providence River. The nearest fortifications are fort on Dutch Island and Fort Adams, R. I.

Money statement.

July 1, 1894, balance unexpended		$2,543.04
Amount appropriated by act of August 17, 1894		17,500.00
		20,043.04
June 30, 1895, amount expended during fiscal year		2,659.10
July 1, 1895, balance unexpended		17,383.94
July 1, 1895, outstanding liabilities	$77.39	
July 1, 1895, amount covered by uncompleted contracts	11,000.00	
		11,077.39
July 1, 1895, balance available		6,306.55
Amount (estimated) required for completion of existing project		47,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		47,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

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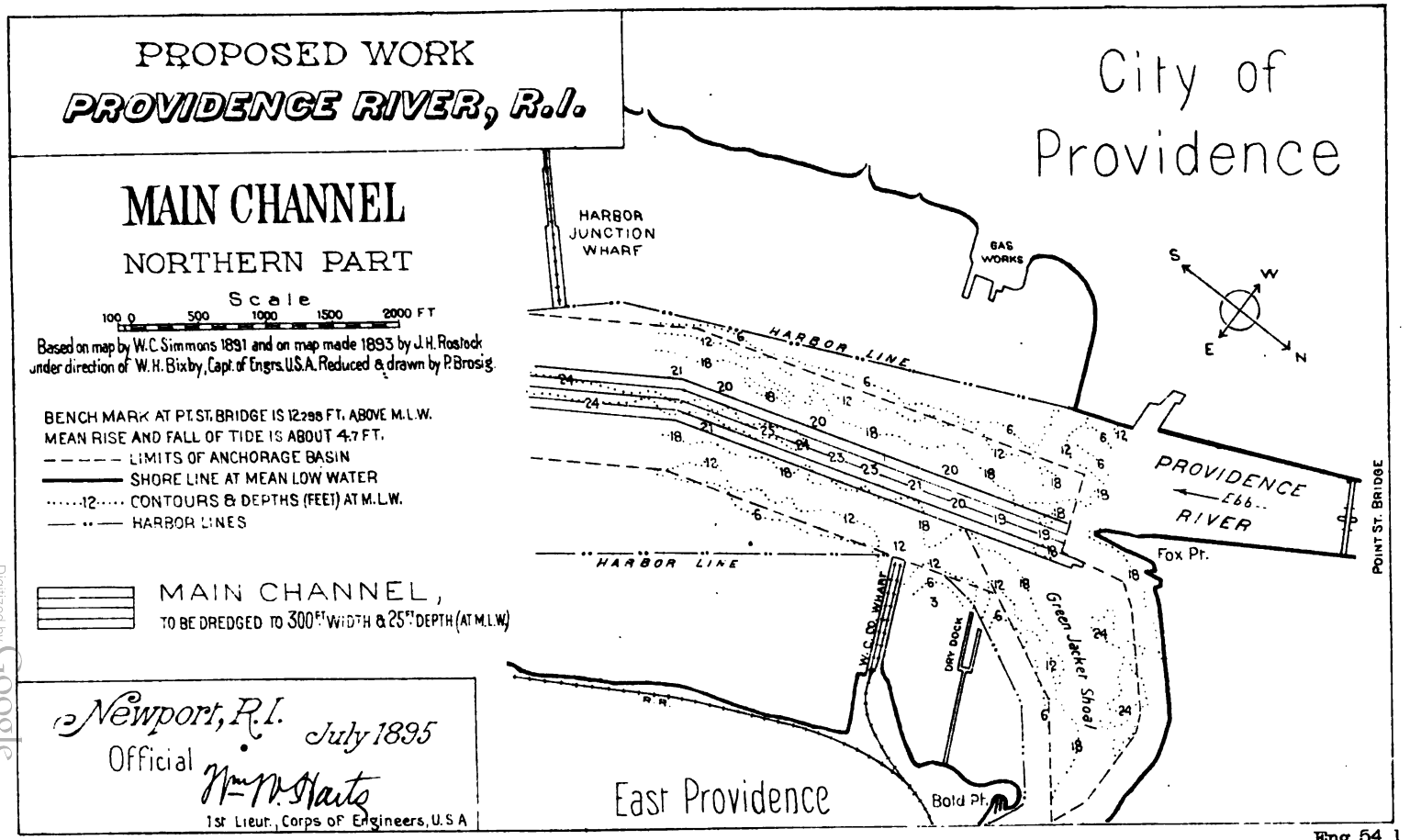
PROPOSED WORK
PROVIDENCE RIVER, R.I.
MAIN CHANNEL
NORTHERN PART
Scale
100 0 500 1000 1500 2000 FT
Based on map by W.C. Simmons 1891 and on map made 1893 by J.H. Rostock under direction of W.H. Bixby, Capt. of Engrs. U.S.A. Reduced & drawn by P. Brosig.
BENCH MARK AT PT. ST. BRIDGE IS 12.298 FT. ABOVE M.L.W.
MEAN RISE AND FALL OF TIDE IS ABOUT 4.7 FT.
LIMITS OF ANCHORAGE BASIN
SHORE LINE AT MEAN LOW WATER
12 CONTOURS & DEPTHS (FEET) AT M.L.W.
HARBOR LINES
MAIN CHANNEL,
TO BE DREDGED TO 300 FT WIDTH & 25 FT DEPTH (AT M.L.W.)
Newport, R.I. July 1895
Official
1st Lieut., Corps of Engineers, U.S.A
City of Providence
HARBOR JUNCTION WHARF
GAS WORKS
HARBOR LINE
PROVIDENCE RIVER
POINT ST. BRIDGE
Fox Pt.
W.C.R.R. WHARF
DRY DOCK
Green Jacket Shoal
East Providence
Bold Pt.
S
W
E
N

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Abstract of proposals opened March 20, 1895, at Newport, R. I., by Capt. W. H. Bixby, U. S. Engineers, for dredging in the river at Providence, R. I.

[Quantity required, about $11,000 worth of work.]

No.	Name and address of bidder.	Price per cubic yard in connection with other work.
		Cents.
1	R. G. & J. S. Packard, New York	*15
2	John H. Fenner, Jersey City, N. J	18

* With Green Jacket Shoal.

Contract awarded to R. G. & J. S. Packard, at 15 cents.

COMMERCIAL STATISTICS.

The commerce arriving and leaving Providence River, Rhode Island, by water during the calendar year ending December 31, 1894, is estimated as follows (based mainly upon reports received from Mr. F. P. Little, secretary of the board of trade, Providence, R. I.):

Class of goods.	Exports.	Imports.	Total.	
			Value.	Tons.
Cotton and products	$20,000	$130,000	$150,000	700
Dry stuffs, etc	.....	45,000	45,000	2,000
Salt	.....	8,000	8,000	5,000
Lumber, lime, and products	.....	524,000	524,000	60,000
Coal, minerals, and products	7,000	4,200,000	4,207,000	1,051,000
Fertilizers	40,000	20,000	60,000	2,000
General merchandise	12,000,000	14,000,000	26,000,000	521,000
Sundries	7,500	7,500	15,000	2,000
Total	12,074,500	18,934,500	31,009,000	1,643,700

Gain over last year, about 470,000 tons; new transportation companies established during the year, none reported.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam:			
Freight and passenger	1,000	18	450
Freight mainly	1,400	20	600
Passenger mainly	1,000	7	300
Fishing	600	3	10
Tugs	6,000	7	150
Pleasure boats	1,500	5	50
Sail:			
Freight	3,000	15	400
Pleasure boats, large	300	7	40
Pleasure boats, small	2,000	3	7
Barges, freight	800	15	1,000

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C 12.

IMPROVMENT OF GREEN JACKET SHOAL, PROVIDENCE, R. I.

Green Jacket Shoal is that part of Providence River which lies off the wharves on the south front of the city of Providence, being an important part of the harbor for anchorage purposes.

Original condition.—That part of the harbor in which the shoal is located is about 2,000 feet long by from 600 to 1,200 feet wide; and of this area the shoal occupied about 30 acres, that part of it which was included between the 15-foot curves measuring about 18 acres. There were channels on either side of the shoal, between it and the harbor lines, having at mean low water a width of 300 feet and a depth of 20 feet on the north side, and a width varying from 50 to 100 feet and a depth of about 15 feet on the south side. The water on the summit of the shoal was only 1 foot deep.

Plan of improvement.—The present approved project, that of 1885, provides for the removal to 25 feet depth at low water of a middle-ground shoal of about 30 acres area in Providence River opposite the city, no portion of the shoal within 200 feet from the harbor lines of the city to be removed by the General Government; all at a total cost estimated in 1885 at $112,346.

A plan of the works may be found at page 598, Annual Report of the Chief of Engineers for 1885, and pages 830 and 832 of 1893.

Appropriations.—Upon the present project appropriations have been made as follows: 1886, $26,250; 1888, $28,000; 1890, $25,000; 1892, $10,000; 1894, $7,500. Total up to June 30, 1895, $96,250.

Amount expended and results to June 30, 1894.—The total amount expended on the present project (including $18.66 outstanding liabilities) up to June 30, 1894, was $88,785.68, by which 20 acres (out of the original 30) had been dredged to 25 feet depth; and a 16-foot depth had been secured over the remaining central and largest portion of the shoal, in addition to a 20-foot depth in the main channel, making an important addition to the anchorage facilities of the harbor.

Operations during the past fiscal year.—Value of United States plant, $7,033. Including $70.97 of outstanding liabilities on June 30, 1895, the expenses of the year were $667.76.

In August a project was approved for the expenditure of the new appropriation of August 17, 1894, the main work of dredging to be done by contract, but other work to be done by hired labor, and the purchase of materials in open market. Under this appropriation bids for dredging were opened, and the contract for about $5,500 worth of work was entered into with Messrs. R. G. & J. S. Packard, of New York, under date of March 30, approved by the Chief of Engineers April 12, 1895, at 15 cents per cubic yard, work to be commenced by July 1 (later extended to July 15) and completed by December 1, 1895.

The contract work was under the local charge of Mr. E. Parrish as assistant engineer.

Work required to complete the existing project.—The work required to complete the existing project is the further deepening of the entire area to its full depth of 25 feet.

Operations contemplated for the fiscal year ending June 30, 1896.—It is proposed to complete the project.

Green Jacket Shoal is in the collection district of Providence, which is a port of entry. The amount of revenue collected at Providence during the last calendar year was $203,987.13. The nearest light-houses are the six light-houses in Providence River. The nearest fortifications are Fort Adams, R. I., and the fort on Dutch Island, Rhode Island.

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PROPOSED WORK

GREEN JACKET SHOAL (PROVIDENCE RIVER), R.I.

DREDGING

Scale

100 0 500 1000 1500 2000 FT

Based on maps of 1884 & '91 and map made 1893 by J. H. Rostock under direction of W. H. Bixby, Corps of Engrs. U.S.A. Reduced & drawn by P. Brosig.

SHORE LINE AT M.L.W.

18 CONTOURS & DEPTHS (FEET) AT M.L.W.

B.M. BENCH MARK AT PT. ST. BRIDGE = 12.298 ABOVE M.L.W.

MEAN RISE AND FALL OF TIDE IS ABOUT 4.7 FT.

DREDGING TO 25.0 FT. DEPTH AT M.L.W.

PRIOR TO JUNE 30. 1894,

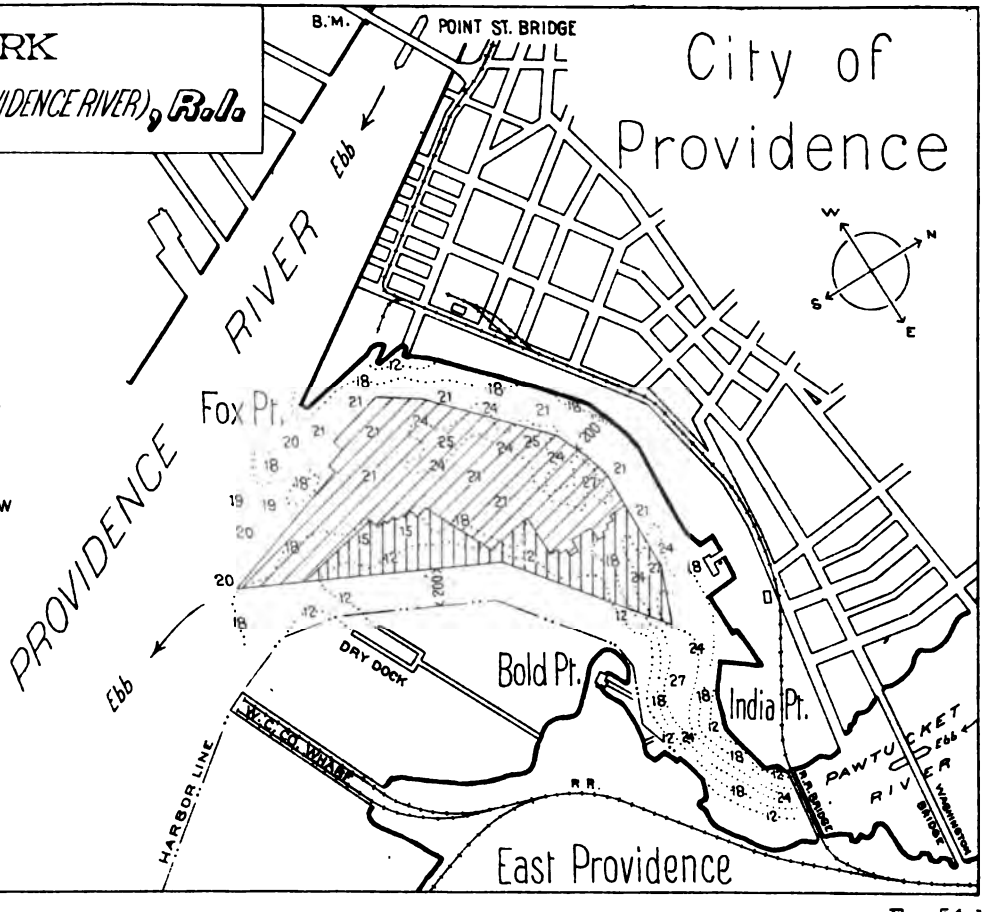
AREA TO BE DREDGED.

Newport, R.I. July 1895

Official

Wm. W. Wauts

1st Lieut., Corps of Engineers, U.S.A.



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Money statement.

July 1, 1894, balance unexpanded		$482.98
Amount appropriated by act of August 17, 1894		7,500.00
		7,982.98
June 30, 1895, amount expended during fiscal year		625.45
July 1, 1895, balance unexpended		7,357.53
July 1, 1895, outstanding liabilities	$70.97	
July 1, 1895, amount covered by uncompleted contracts	5,500.00	
		5,570.97
July 1, 1895, balance available		1,786.56
Amount (estimated) required for completion of existing project		15,596.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		15,596.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals opened March 20, 1895, at Newport, R. I., by Capt. W. H. Bixby, U. S. Engineers, for dredging at Green Jacket Shoal in the harbor at Providence, R. I.

[Quantity required, about $5,500 worth of work.]

No.	Name and address of bidder.	Price per cubic yard in connection with other work.
		Cents.
1	John H. Fenner, Jersey City, N. J.	*20
2	R. G. & J. S. Packard, New York	*15

* With Providence.

Contract awarded to R. G. & J. S. Packard at 15 cents.

C 13.

IMPROVEMENT OF NEWPORT HARBOR, RHODE ISLAND.

Newport Harbor is at the main entrance to Narragansett Bay. This bay during the entire year offers an easily accessible harbor of refuge for our European and coastwise commerce quite equal in almost every respect to any harbor on this coast. Newport Harbor, lying at the eastern entrance to this bay and forming a part of it, has been used by vessels from very early times on account of its accessibility and well-sheltered location.

The objects of the improvement are to widen and deepen the southern (the main) entrance to the harbor and to enlarge its capacity for vessels seeking refuge in storms by increasing the area and depth of the anchorage within it. The mean rise and fall of the tide is about $3\frac{3}{4}$ feet.

Original condition.—Before improvement the capacity of the inner harbor was limited by shoals, and it was not sufficient for the vessels seeking it for refuge. The southern (the main) entrance was obstructed by a bar which stretched out from Goat Island and the northern entrance, near Rose Island, by a sharp rocky spit, and the general business wharves of the city could not be reached at low tide by vessels drawing more than 8 feet.

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Between 1873 and 1875, $28,500 was appropriated to dredge a 12-foot channel up to the city wharves and build a small jetty to arrest the flow of sand into the main channel and harbor, and to protect the western face of Goat Island. (See p. 29 of Annual Report of 1873.) This work was completed in 1876.

At the adoption of the present project this harbor was limited to 12 feet depth at low water, and its anchorage area too small for the craft seeking harborage at this place during the summer and all the year during storms.

Plan of improvement.—The present approved project, that of 1880, as modified in 1882, 1883, 1884, 1890, and 1895, provides for the widening and deepening of the channel from Narragansett Bay into Newport, so as to secure 15 feet depth at low water, with at least 750 feet width; for the extension of the 13-foot-depth and 10-foot-depth anchorage basins; for the partial cutting off of the shoal spit at the southern end of Goat Island, and for the construction of jetties on the western shore of Goat Island, so as to protect the end of this island from erosion, and to prevent the drift of sand, etc., around the island into the adjacent parts of the channel and harbor and for the removal of "Spindle Rock," a sharp rocky spit near Rose Island; all at a total cost estimated in 1895 at $206,200.

A plan of the work may be found at page 604, Annual Report of the Chief of Engineers for 1885, and page 838 of 1893; and further details at page 562 of 1881, page 561 of 1882, page 494 of 1883, page 624 of 1884, page 736 of 1891, and page 627 of 1892.

Appropriations.—Upon the present project appropriations have been made as follows: 1881, $25,000; 1882, $20,000; 1884, $20,000; 1886, $15,000; 1888, $12,000; 1890, $12,500; 1892, $25,000; 1894, $7,500. Total up to June 30, 1895, $137,000.

Amount expended and results to June 30, 1894.—The total amount expended on the present project (including $32.28 outstanding liabilities) up to June 30, 1894, was $127,591.35, by which the 15-foot-depth channels and 13-foot-depth anchorage basins had been dredged, the shoal spit at the southern end of the island had been cut off, and one jetty, 133 feet long, had been built westward from Goat Island. The old pile dolphin marking the former end of the spit had been removed and a new pile dolphin built to mark the new end of this island. An electric light is now maintained on this dolphin by means of the electric plant of the United States naval torpedo station.

Operations during the past fiscal year.—Value of United States plant, $2,473. Including $54.73 outstanding liabilities on June 30, 1895, the expenses of the year were $1,423.94.

The remaining small amount of dredging opposite the Goat Island spit, under the 1892 appropriation, was done in October by the Government plant, 2,000 cubic yards of mud, sand, and gravel being removed to a depth of 15 feet at low water from the several small shoal spots in the harbor, completing all dredging under the 1892 appropriations. In August a project was approved for the expenditure of the new appropriation of August 17, 1894; the main work of dredging and removal of Spindle Rock to be done by contract, but other work to be done by hired labor and the purchase of materials in open market. A survey was made in September and October, to ascertain the extent, etc., of the Spindle Rock obstruction. A subproject, based on the recent survey, for removal of this obstruction was submitted, and approved in May, and bids (to be opened in July) were solicited for ledge rock removal under the 1894 appropriation.

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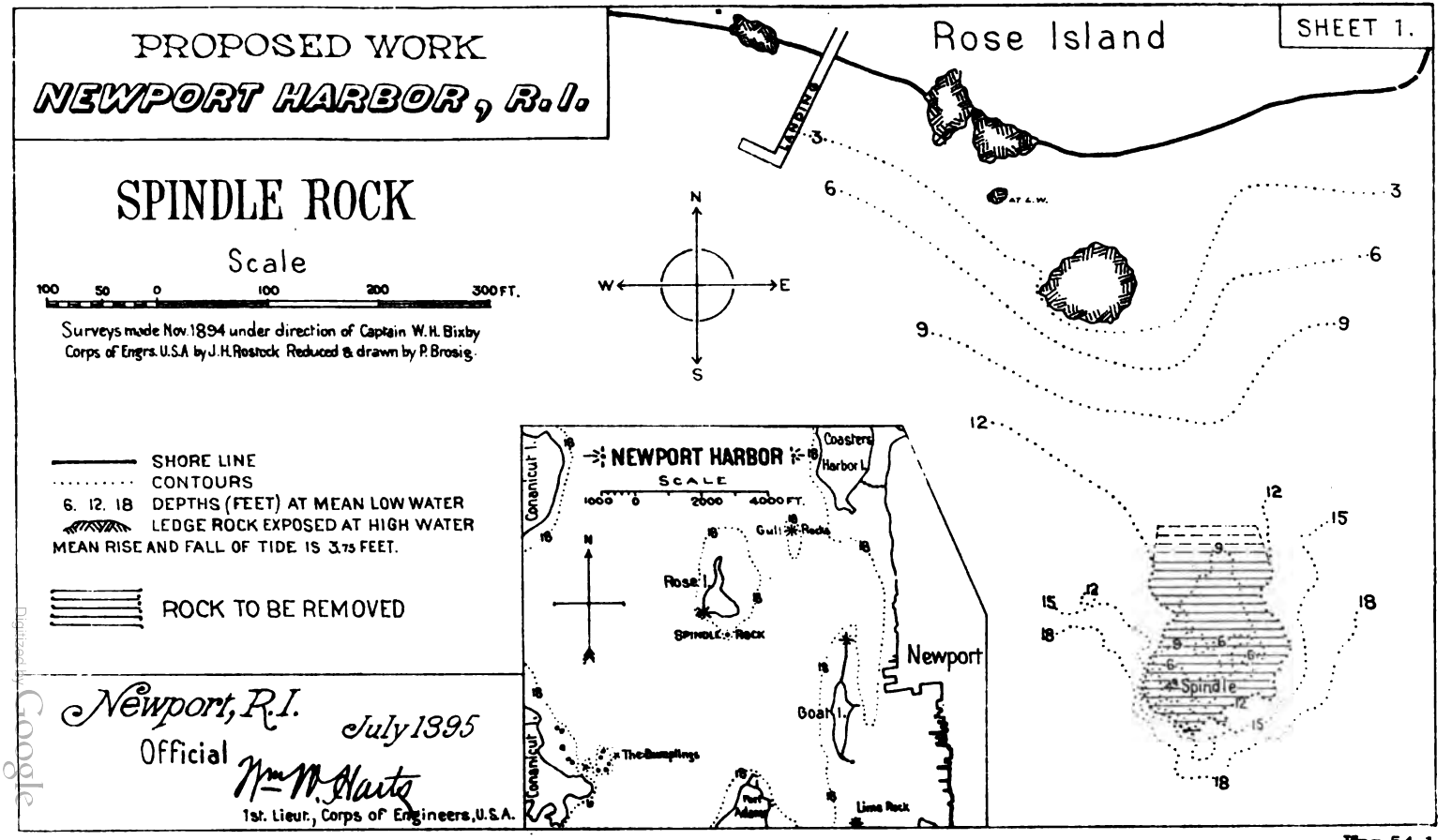

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PROPOSED WORK
NEWPORT HARBOR, R.I.

SOUTHERN PART OF HARBOR

Scale

100 0 500 1000 1500 2000 FT.

Based on maps made 1884-'94 under direction of the Newport U.S. Engr. Office.
Reduced & drawn in office of Capt. W.H. Bixby, U.S. Engrs. by P. Brosig.

BENCH MARK AT FINCH ENGS & CO. STORE IS 11.58 FT. ABOVE M.L.W.
MEAN RISE AND FALL OF TIDE IS 3.75 FT.

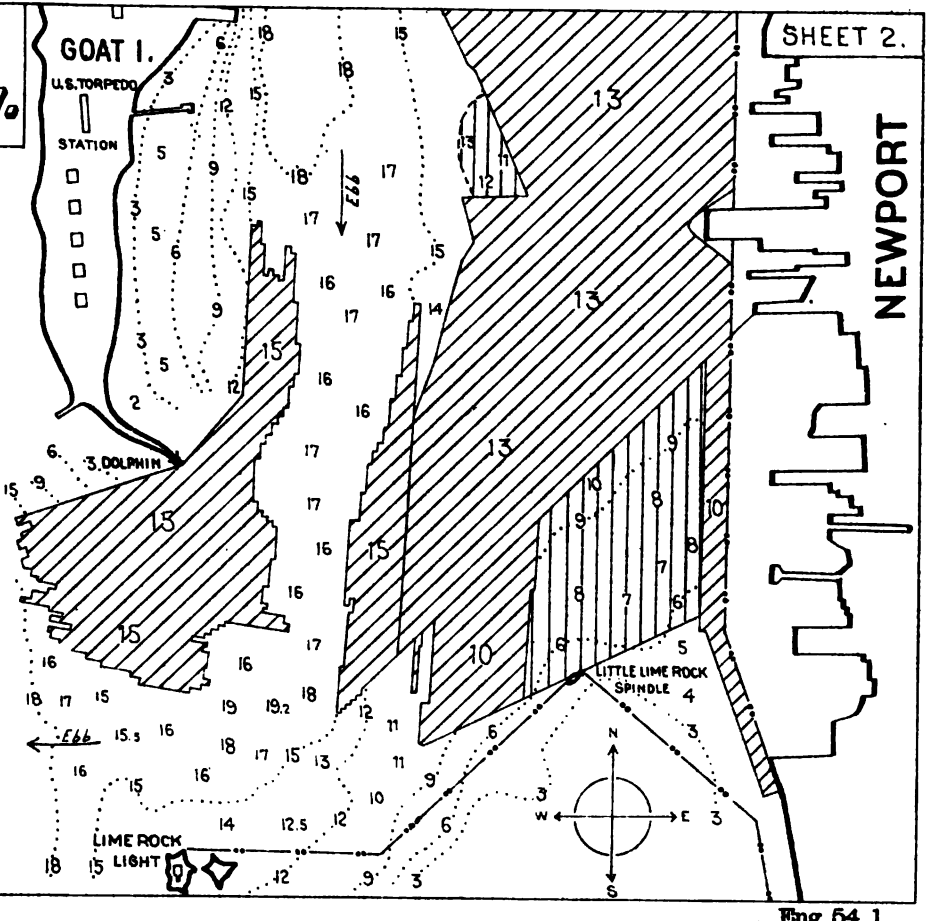
——— SHORE LINES
—·—·—·— HARBOR LINES
·····18····· CONTOURS & DEPTHS (FEET) AT M.L.W.

▨ DREDGING PRIOR TO JUNE 30. 1894
▥ DREDGING PROPOSED
— · —

Newport, R.I. *July 1895*

Official *Wm. N. Haute*

1st. Lieut., Corps of Engineers, U.S.A.



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This work was under the local charge of Mr. Edward Parrish, as assistant engineer, and the survey was under Mr. J. H. Rostock, as assistant engineer.

Work required to complete the existing project.—The work required to complete the existing project is the excavation of the 10-foot anchorage area within the harbor and the building of additional jetties outside of Goat Island, whenever they may be required to arrest the drift of littoral sand and gravel into the harbor entrance, and the removal of the obstructing portions of Spindle Rock.

Operations contemplated for the fiscal year ending June 30, 1896.—It is proposed to remove a portion of "Spindle Rock."

Newport is in the collection district of Newport, and is a port of entry. The amount of revenue collected at Newport in the last calendar year was $450.70. The nearest light-houses are Lime Rock and Newport (Goat Island) lights. The nearest fortification is Fort Adams, Newport, R. I.

Money statement.

July 1, 1894, balance unexpended	$1,940.93
Amount appropriated by act of August 17, 1894	7,500.00
	9,440.93
June 30, 1895, amount expended during fiscal year	1,401.49
July 1, 1895, balance unexpended	8,039.44
July 1, 1895, outstanding liabilities	54.73
July 1, 1895, balance available	7,984.71
Amount (estimated) required for completion of existing project	69,200.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	69,200.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS.

The commerce arriving and leaving Newport Harbor, Rhode Island, by water during the calendar year ending December 31, 1894, is estimated as follows (based mainly upon reports received from Martin H. Ball, deputy collector of customs, and many other citizens of Newport, R. I.):

Class of goods.	Exports.	Imports.	Total.	
			Value.	Tons.
Cotton and products		$30,000	$30,000	150
Tobacco		50,000	50,000	50
Grains and forage		25,000	25,000	1,000
Vegetables and truck		50,000	50,000	600
Live stock and products		144,000	144,000	2,400
Fish, oysters, etc.	$15,000	41,000	56,000	8,000
Naval stores		24,000	24,000	80
Lumber and products		300,800	300,800	13,260
Coal, minerals, and products		460,000	460,000	75,000
Fertilizers		5,500	5,500	125
General merchandise	350,000	1,000,000	1,350,000	15,000
Sundries	100,000	200,000	300,000	3,000
Total	465,000	2,330,300	2,795,300	118,665

Compared with last year, there is a slight loss in commerce; new transportation companies established during the year, none.

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The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one.):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam:			
Freight and passenger	1,200	12	1,500
Freight mainly	300	10	1,000
Passenger mainly	3,600	8	500
Fishing	100	7	350
Tugs	500	7	80
Pleasure boats	1,000	7	100
Sail:			
Freight	1,000	10	150
Fishing boats	500	6	15
Pleasure boats, large	1,000	4	5
Pleasure boats, small	2,500	2	3
Barges:			
Freight	200	12	250

C 14.

HARBOR OF REFUGE AT POINT JUDITH, RHODE ISLAND.

Point Judith is the southeastern extremity of South Kingston, R. I., and marks the southwestern entrance to Narragansett Bay.

Original condition.—Its shores are covered with bowlders, and a number of wrecks are scattered along the beach on each side of the point. A long ledge, known as Squid Ledge, about 1½ miles west of the point, extends for nearly a mile in a south by easterly direction.

At the adoption of the present project this point was a specially dangerous place for boats and tows to pass during storms and even ordinarily bad weather.

Plan of improvement.—The present approved project, that of 1889, provides for the construction of a national harbor of refuge nearly a mile square at this point by means of stone breakwaters built partly on Squid Ledge and planned so as to give protection against easterly, southerly, and westerly storms, the mainland itself forming a protection on the north; all at a total cost estimated in 1889 at $1,250,000.

By the act of July 13, 1892, authority was given to the Secretary of War to make contracts for the completion of the project on the basis of the above-estimated total cost, the work to be paid for as appropriations may from time to time be made by law.

A description of the works may be found at page 595, Annual Report of the Chief of Engineers for 1890, and a general plan of the same in House Ex. Doc. No. 66, Fifty-first Congress, first session, and page 840 of 1893.

Appropriations.—Upon the present projects appropriations have been made as follows: 1890, $75,000; 1892, $75,000; 1893, $100,000; 1894, $100,000; 1895, $300,000. Total up to June 30, 1895, $650,000.

Amount expended and results to June 30, 1894.—The total amount expended on the present project (including $35,482.28 outstanding liabilities) up to June 30, 1894, was $198,752.46, by which the breakwater had been commenced at its center, extended to a total length of about 3,000 feet on the bottom, and about 1,000 feet length raised to about low-water level, and a beacon light established thereon.

Operations during the past fiscal year.—Value of United States plant, $12,081. Including $77,626.44 outstanding liabilities on June 30, 1895, the expenses of the year were $252,510.96.

In August a subproject was approved for the expenditure of the new appropriation ($100,000) of August 18, 1894, and in March a subproject

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PROGRESS MAP FOR 1895

HARBOR OF REFUGE

AT

POINT JUDITH, R.I.

FROM 1. JULY 1894 TO 30. JUNE 1895

BREAKWATER

Scales

LENGTHS

100 0 500 1000 1500 2000 2500 FT.

WIDTHS

10 0 50 100 FT.

DEPTHS & HEIGHTS

10 5 0 10 15 20 FT.

Based on maps made 1889–93 under direction of the Newport U.S. Engineer Office. Reduced & drawn in office of Capt. W.H. Bixby, Corps of Engrs. U.S.A. by P. Brosig.

WORK DONE

- PRIOR TO JUNE 30. 1894.
- DURING FISCAL YEAR 1894/5.
- UNCOMPLETED OR PROPOSED.

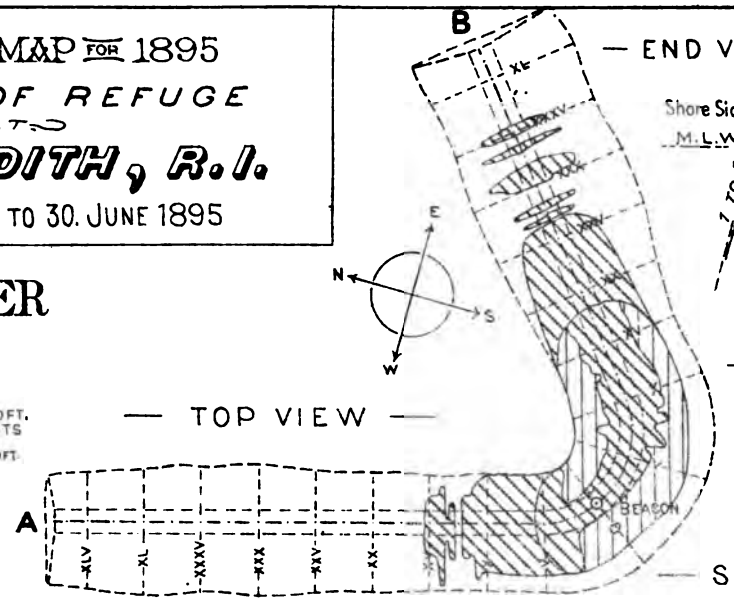
Newport, R.I. July 1895

Respectfully submitted

Wm. W. Harts

1st. Lieut., Corps of Engineers, U.S.A.

— TOP VIEW —



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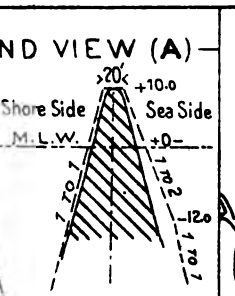

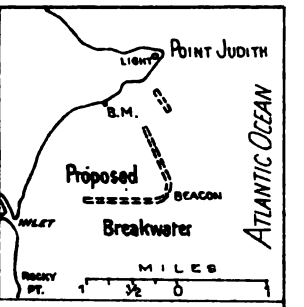

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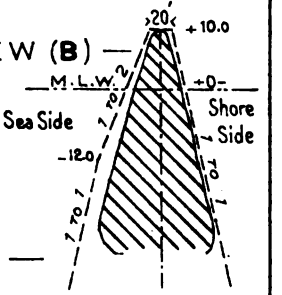
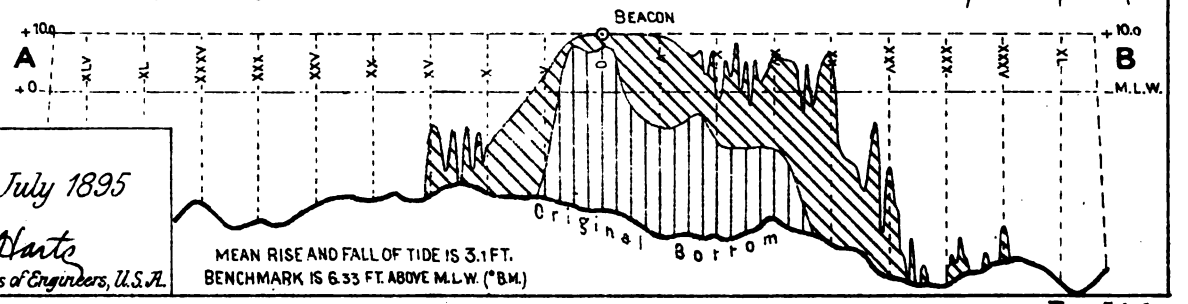


— SIDE VIEW —



MEAN RISE AND FALL OF TIDE IS 3.1 FT.

BENCHMARK IS 6.33 FT. ABOVE M.L.W. ("B.M.)

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was approved for the expenditure of the new appropriation ($300,000) of March 2, 1895; the main stonework to be done by contract, but other work to be done by hired labor and the purchase of materials in open market. Stonework in progress at the commencement of year under the 1893 appropriation was continued by the contractor until November 20 (when both the 1893 and 1894 appropriations were exhausted) and was resumed on April 8 under the 1895 appropriation, and 193,087 tons of stone were towed to the place of work and placed on the two wings of the breakwater near the beacon, making 286,026 tons in all under this contract; thereby extending the breakwater to a total length of about 5,000 feet on the bottom, about 2,600 feet length to low-water level, and about 700 feet length to above low-water level.

This work was under the local charge of Mr. Edward Parrish as assistant engineer, with Mr. John A. Dill and Mr. Lawrence L. Gaillard as inspectors.

Work required to complete the existing project.—The work required to complete the existing project is the extension of the breakwater.

Operations contemplated for the fiscal year ending June 30, 1896.—It is proposed to apply the balance on hand and the next appropriation to continuing the construction of the breakwaters.

Point Judith is in the collection district of Newport, which is a port of entry. The amount of revenue collected at Newport in the last calendar year was $450.70. The nearest light-house is Point Judith Light. The nearest fortification is the fort on Dutch Island, Rhode Island.

Money statement.

July 1, 1894, balance unexpended		$86,729.82
Amount appropriated by sundry civil act approved August 18, 1894		100,000.00
Amount appropriated by sundry civil act approved March 2, 1895		300,000.00
		486,729.82
June 30, 1895, amount expended during fiscal year		210,366.80
July 1, 1895, balance unexpended		276,363.02
July 1, 1895, outstanding liabilities	$77,626.44	
July 1, 1895, amount covered by uncompleted contracts	140,244.46	
		217,870.90
July 1, 1895, balance available		58,492.12
Amount (estimated) required for completion of existing project		660,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		600,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

COMMERCIAL STATISTICS.

The number of vessels passing Point Judith, Rhode Island, during the calendar year ending December 31, 1894, is estimated as follows:

Character or class of service.	Number.	Average approximate tonnage.	Total tonnage.
		Gross tons.	*Gross tons.*
Steamers (freight, fish, and passengers)	12,000	500	6,000,000
Yachts (steam and sail)	7,000	100	700,000
Schooners (2, 3, and 4 masts)	34,000	600	20,400,000
Ships (barks and barkentines)	200	900	180,000
Brigs and brigantines	200	300	60,000
Sloops	2,000	20	40,000
Barges	9,600	300	2,880,000
Total	65,000		30,260,000

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C 15.

IMPROVEMENT OF ENTRANCE TO POINT JUDITH POND, RHODE ISLAND.

Point Judith Pond is a shallow salt pond, lying in rear of the sandy beach of the Rhode Island shore, just west of Point Judith.

The improvement desired at this place by the people of the neighborhood is the reopening of an old entrance long ago closed by the ocean storms.

The present entrance to this pond is very shallow (less than 3 feet), crooked, and variable in location, and lies about a mile to the westward of the former entrance (now closed), where the improvement is desired.

Plan of improvement.—There is at present no approved project for this work, it having been reported as not worthy of improvement in 1873 by General Warren (pp. 286–289, Part II, Annual Report of the Chief of Engineers for 1874, and House Ex. Doc. No. 84, Forty-third Congress, first session), and also in 1888 by Major Livermore (pp. 642–643, Annual Report for 1889), and also in 1893 by Captain Bixby (see pp. 841 and 879, Annual Report for 1893). The appropriation for 1894 orders that all money so far appropriated shall be used in improving the former entrance to said pond.

Appropriations.—Two appropriations have been made for this work—that of 1892 for $7,500 and of 1894 for $2,500; total, $10,000.

Amount expended and results to June 30, 1894.—The total amount expended on this work up to June 30, 1894, was $152.62. No field work had yet been done except in the way of examination. The locality had been inspected. A special report had been submitted on January 24, 1893, as to the advisability of adopting a new location for the pond entrance. There were no funds available for work, all preceding appropriations having been turned into the Treasury because of the apparent unworthiness of the work.

Operations during the past fiscal year.—Value of the United States plant, $30. Including $130.62 of outstanding liabilities the expenses of the year were $325.59.

In August a project was approved for work under the new appropriation of August 17, 1894 (and former appropriations as provided for in the 1894 appropriation bill), so far as to include a survey, with detailed project and estimate, work to be done by hired labor and the purchase of materials in open market. The survey was made in May and June and the detailed project and estimate was submitted for the action of the War Department.

This work was in the local charge of Mr. J. H. Rostock, as assistant engineer.

Point Judith Pond is in the collection district of Newport, which is a port of entry. The amount of revenue collected at Newport in the last calendar year was $450.70. The nearest light-house is Point Judith Light. The nearest fortification is the fort on Dutch Island, Rhode Island.

Money statement.

July 1, 1894, balance unexpended	$7,347.38
Amount appropriated by act of August 17, 1894	2,500.00
	9,847.38
June 30, 1895, amount expended during fiscal year	194.97
July 1, 1895, balance unexpended	9,652.41
July 1, 1895, outstanding liabilities	130.62
July 1, 1895, balance available	9,521.79

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REPORT OF LIEUT. WILLIAM W. HARTS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., July 2, 1895.

GENERAL: In accordance with the provisions of the letter from your office, dated August 27, I have the honor to submit herewith a report upon a survey of the former entrance to Point Judith Pond, with a detailed project for its improvement as provided for by the river and harbor act of August 17, 1894.

Description.—Point Judith, a long, sharp, rocky headland, is at the southern extremity of the Narragansett shore of Rhode Island, and extends southward into the Atlantic Ocean, where it lies very much exposed to all the severe southerly storms of this region. To the southwest of this point the Government is now constructing an expensive harbor of refuge, to be used by vessels caught by southerly storms in this dangerous vicinity. Behind this breakwater and about a mile westward from Point Judith lies Point Judith Pond, a large shallow inland lake, well interspersed with various sized islands. This pond is triangular in general shape with its base of about 1.25 miles approximately parallel to the ocean, and with its apex near Wakefield, about 4 miles farther north. The entire area of this pond is about 1,800 acres, of which less than one-third is over 6 feet depth, and much less than one-tenth is over 10 feet depth, the deeper portions being in the shape of long narrow strips running in a general northerly and southerly direction between the islands in its middle portions. Near Wakefield and near the ocean the depths for long distances are less than 3 feet. But the pond level, which remains practically the same during high and low tide in the ocean, is shown by the recent survey (corroborated in general by former surveys) to be about 2.5 feet above ocean low water, so that if a deep channel were cut from the ocean to the pond, the present depths in the pond and its areas of deep water would probably be much diminished. This pond is separated from the ocean on the south by a sand and gravel beach of about 1,000 to 3,800 feet width, through which, at the southwestern corner of the pond, there now runs a shallow breachway easily fordable by ox teams and connecting the pond with the ocean. It is reported that the pond entrance was formerly about a mile east of its present position—that is, at the southeastern corner of the pond, and opened on the ocean side into a small cove called Sand Hill Cove. It is also reported that many years ago, previous to 1815, this entrance was large enough to allow the passage of small vessels of from 5 to 200 tons burden, but that by a single severe storm the entrance was closed so completely that the pond, on rising, cut a new outlet somewhere near its present position. The last river and harbor act provided for the improvement of the "former entrance"—that is, of the entrance of 1815.

Those advocating some improvement of this locality, principally landholders of the neighborhood, have for many years urged the General Government to undertake the improvement of this pond and vicinity, and lately to reopen the old breachway, so that vessels can again pass from the ocean into the pond, and thus possibly open a water commerce with Wakefield and other interior towns, besides improving oyster and other fisheries.

In 1873 an examination and survey of this pond was ordered by Congress and was made under direction of General Warren, Corps of Engineers, but adversely reported on by him (see H. R. Ex. Doc. 84, Forty-third Congress, first session), on the ground that the cost of any

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improvement that would be useful would be, in his opinion, so great that the amount of commerce to be benefited would not justify the expenditure. Again in 1888, an examination of the entrance to this pond was ordered by Congress and a report thereon was submitted by Maj. W. R. Livermore, Corps of Engineers, in which he reported that "in my opinion the entrance to Point Judith Pond, west of Point Judith, is not worthy of improvement" (see pp. 642–644 Annual Report of Chief of Engineers for 1889). A third examination was ordered by Congress and made in 1892 by Captain Bixby, Corps of Engineers, in his report of which Captain Bixby explained that the improvement of this locality would be principally of local benefit and gave it as his opinion (in which General Abbot, Corps of Engineers, concurred) that this locality "is decidedly not at present worthy of improvement by the General Government." (See pp. 877–880, Annual Report of Chief of Engineers for 1893, where a fuller description of this locality may be found).

By act of August 17, 1894, $2,500 was appropriated by Congress, and this amount and $7,347.38 left over from a former appropriation ($9,847.38 in all) was ordered to be spent on the work of the improvement of the former entrance to this pond. This former entrance having filled up many years ago, as described above, is now no part of the navigable water of the United States, and if this entrance is now to be reopened it will necessitate cutting through about 3,600 feet of gravelly beach and a marsh to which the United States has at present no legal title. In addition, a raised roadway crosses this marsh and beach and the site of the old entrance, and has probably been open long enough to legally entitle those needing to use it to a right of way thereon. This might perhaps compel the United States to provide some other means of communication, such as a bridge, with its attendant expenses for draw tender, etc., if this roadway were to be obstructed by an open channel. It would seem, therefore, that before work on the improvement of this beachway can be begun, the United States should by law (Rev. Stats., sec. 355) acquire title to enough land where the desired channel is to be placed, so that there will be room for channel, spoil banks, etc., and the United States should also either take such legal steps as would be necessary to close the existing road or should otherwise be prepared to provide a bridge for the use of such roadway.

Plans of improvement.—The inclosed map shows the results of the recent survey and the location, in plan, of a proposed channel way along the site of the former entrance, and connecting the ocean with the pond, such as is possible under the provisions of the river and harbor act of August 17, 1894. It is proposed to first purchase a strip of land about 50 feet wide extending from the ocean to the pond, consisting of about 6 acres in all, to erect a small bridge over the channel way where the road crosses it, and to make this channel 10 feet wide and 1 foot deep at ocean low water. Larger dimensions than these are not now possible with funds at present on hand, and any further appropriations seem inadvisable owing to the fact that this pond entrance is apparently unworthy of any improvement at present by the General Government. (See previous reports, referred to above, of all U. S. Engineer officers who have examined this locality and reported thereon.)

Cost.—The land in the vicinity of this old entrance is practically valueless except perhaps as a location for a summer resort, which has already been so much talked about that prices are already immoderately high, land being now held at from $400 to $500 per acre. In my opinion, however, the 6 acres necessary to be purchased will not cost more than $2,200, as only that part near the ocean and along the beach is considered specially valuable. The proposed narrow cut is too small

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for any floating dredge that would probably be available in this vicinity, and its depth likewise too slight, so that this channel would have to be dug either by hand labor or else perhaps by some kind of land ditching machine. For this reason, and owing to much of the channel being marshy, the cost of this excavation would likely not be less than 50 cents per cubic yard. The excavation of this channel will require the removal of not less than 11,000 cubic yards, making the cost of dredging $5,500. A small roadway bridge sufficient for present needs could be built for $500. The cost therefore of this improvement would be as follows:

Purchase of 6 acres	$2,200.00
Roadway bridge	500.00
Dredging cut, 11,000 yards, at 50 cents	5,500.00
Total	8,200.00
About 20 per cent contingencies and superintendence	1,647.38
	9,847.38
Amount available	9,847.38

It will in my opinion be best, and it is so now proposed, that the main work of excavation be done by contract, if bids can be obtained which shall be advantageous and economical to the Government; but that the superintendence and all minor work be done by hired labor, the use of the Government plant, and the purchase of material in open market.

In conclusion, I desire to give it as my opinion, after careful investigation and study of this special subject, that the only apparent benefit to be derived from any improvement of this pond entrance is a small increase of its local fishing industries, a large increase in the value of its real estate, and perhaps a small increase in its local commerce, and that even if the benefits secured were sufficient to justify the expenditure necessary for these improvements it seems to me that this benefit would be so local in its nature that the expenses therefor should not be borne by the United States.

Respectfully submitted.

WM. W. HARTS,
First Lieut., Corps of Engineers.

Brig. Gen. WM. P. CRAIGHILL,
Chief of Engineers, U. S. A.

(Through Col. H. L. Abbot, Corps of Engineers, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, July 5, 1895.

Respectfully forwarded to the Chief of Engineers, U. S. Army. I have personally examined the site of this proposed work and concur in the views expressed by Lieutenant Harts. The construction of the outer breakwater, now in progress, will afford all needful protection to vessels navigating these waters. The deepening of the traditional "former entrance" to Point Judith Pond will probably be only a temporary improvement, as, if it ever existed, it has certainly been effectually closed by natural causes.

The within project conforms to the requirements of the act of August 17, 1894, and for that reason only is recommended by me.

HENRY L. ABBOT,
Colonel of Engineers, Bvt. Brig. Gen., U. S. A.,
Division Engineer.

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[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
July 17, 1895.

Respectfully submitted to the Secretary of War.

Point Judith Pond is a triangular-shaped inland lake of an area of about 1,800 acres, lying about a mile westward of Point Judith at the southern extremity of the Narragansett shore of Rhode Island, and having a depth of from 3 to 10 feet. The pond is separated from the ocean on the south by a sand and gravel beach of about 1,000 to 3,800 feet width, intersected at the southwestern corner of the pond by a shallow breach way connecting the pond with the ocean. The original entrance to this pond was formerly about a mile east of its present position, and is reported to have been completely closed up by a severe storm.

Examinations and surveys of this pond have been repeatedly made, in accordance with Congressional directions, with a view to its improvement and the improvement of its former entrance. The first was made in 1873, under direction of General Warren, who reported on the ground that the amount of commerce to be benefited would not justify the expenditure of the large amount that would be necessary to accomplish a useful improvement. Another examination was made in 1888 by Major Livermore, and still another in 1892 by Captain Bixby, both of whom reported that the improvement of the locality would be chiefly of local benefit and should not be undertaken by the General Government.

The river and harbor act of August 17, 1894, contains the following provision:

> Entrance to Point Judith Pond, two thousand five hundred dollars, which, together with the previous unexpended appropriation, shall be used in improving former entrance to said pond.

The amount made available for the work by this provision is $9,847.38.

A survey of the locality, with a view to securing data from which to prepare a detailed project and estimate, has been made, and attention is respectfully invited to the within report thereon. It appears that if this entrance to this pond is to be reopened it will necessitate cutting through about 3,600 feet of a gravelly beach and a marsh to which the United States has at present no legal title, and the crossing of a roadway which has been in use long enough to probably entitle the persons using it to a right of way thereon, thus compelling the United States to build and maintain a bridge and provide a draw tender therefor.

Lieutenant Harts, the officer making report, after careful investigation and study of the subject, gives it as his opinion, "that the only apparent benefit to be derived from any improvement of this pond entrance is a small increase of its local fishing industries, a large increase in the value of its real estate, and perhaps a small increase in its local commerce." He is further of the opinion that even if the benefits secured were sufficient to justify the expenditure necessary, such benefits would be so local in their nature that the expenses therefor should not be borne by the United States.

The Government is now constructing an outer breakwater at great expense, a little to the southwest of Point Judith, which will form a harbor of refuge for vessels caught by storms in the vicinity, and Colonel Abbot, the division engineer, while concurring in the views of Lieutenant Harts, expressed the opinion that this breakwater will afford all needful protection to commerce in these waters. I concur in the views

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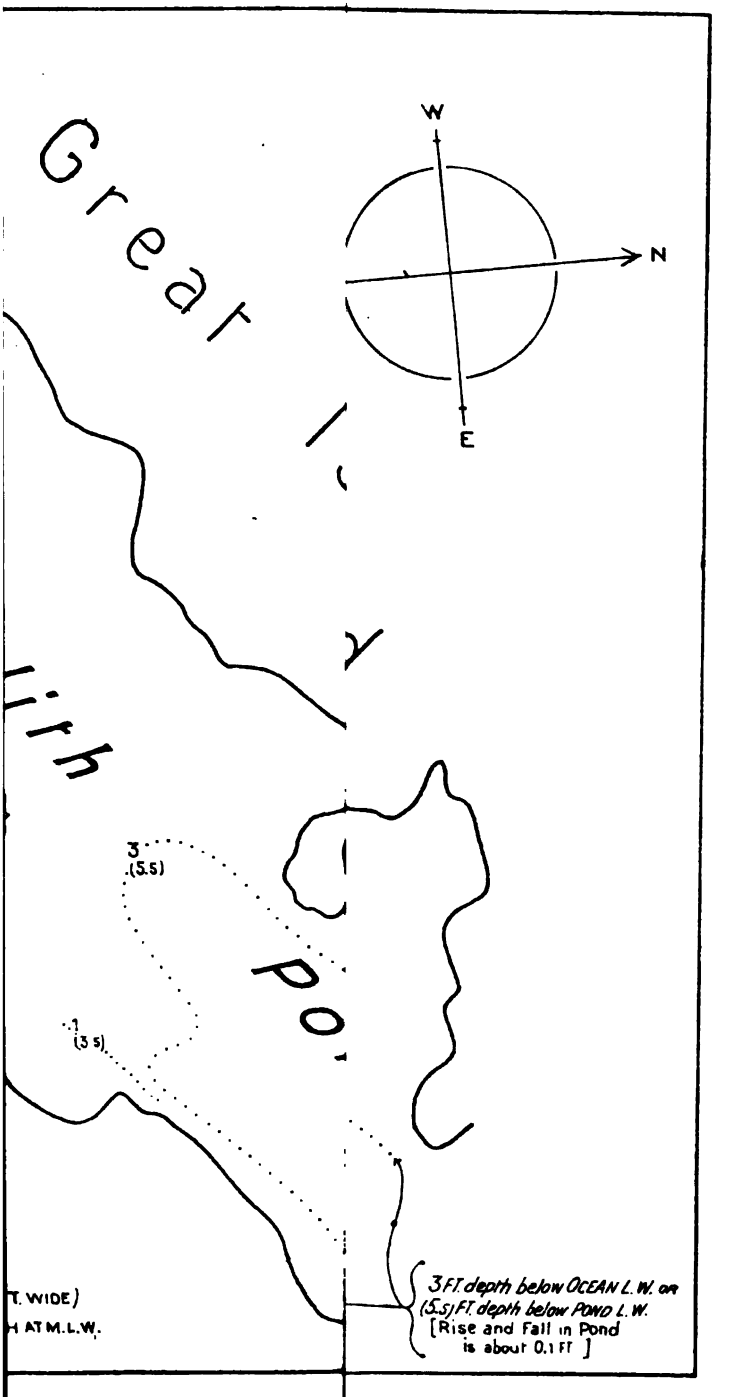

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of these officers and submit the report to the Secretary of War with request for instructions, whether the money shall be now expended in accordance with the act of August 17, 1894, or action delayed until the subject can be again considered by Congress with the additional information furnished by the recent survey.

WM. P. CRAIGHILL,
Brig. Gen., Chief of Engineers.

[Third indorsement.]

WAR DEPARTMENT, *July 19, 1895.*

Let action be delayed until the subject can again be considered by Congress, as suggested by the Chief of Engineers.

By order of the Secretary of War:

JOHN TWEEDALE,
Chief Clerk.

C 16.

HARBOR OF REFUGE AT BLOCK ISLAND, RHODE ISLAND.

This island is part of the State of Rhode Island; is 14 miles east of Montauk Point, the eastern end of Long Island, and is about 10 miles from the nearest point of the mainland. Besides supplying the wants of the mackerel-fishing fleet and the general coast navigation the island is an important point on our shores for ocean navigation. It has a signal station connected by submarine telegraph with the mainland. Vessels are passing the island at all times and on all sides of it, and its position renders it of national importance. The object of the improvement is to furnish a harbor of refuge for medium-draft vessels engaged in foreign and coastwise commerce. The mean rise and fall of the tide is about 3 feet.

Original condition.—Before the construction of the present harbor of refuge Block Island had no harbor which afforded protection for decked vessels. The only ones used were open boats, which, on the approach of storms, were hauled up on the beach by oxen. The largest of these boats were of about 10 tons burden.

Between 1870 and 1876 $285,000 was appropriated to build a breakwater for a harbor of medium-draft vessels. This work, including an inner harbor of 7 feet depth for temporary use of the Government plant, was completed in 1878. (See p. 202 of Annual Report of 1877 and p. 313 of 1879.)

In 1880 $6,000 was appropriated for dredging the inner basin to 9 feet depth. This work was completed in 1881. (See p. 390 of Annual Report of 1880 and p. 563 of 1881.)

In 1882 $19,000 was appropriated for building a sea wall on the east side of the inner basin and protecting the cliffs on east side of breakwater. (See p. 563 of Annual Report of 1882.) This work was completed in 1884.

In 1884 $15,000 was appropriated for additions to the old breakwater. (See p. 628 of Annual Report of 1884.) These additions were made in 1884–85, partially closing a gap in this old breakwater.

At the adoption of the present project this harbor was neither large enough nor well enough protected for the proper harborage of the craft seeking refuge at this place during storms and bad weather.

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Plan of improvement.—The present approved project, that of 1884 as modified in 1888, provides for the construction of a harbor of refuge on the eastern side of the island, consisting of an enlarged inner harbor (or basin) for small vessels and an exterior harbor for large ones. The basin was to be about 800 feet square and completely inclosed except at its 100-foot-wide entrance. The exterior harbor was already formed by an old breakwater on the east and the adjacent shore on the south and west, but an old gap near the end of this breakwater was to be filled up. The project covers the construction of the stone sea walls of the enlarged inner harbor ($46,000), the repair of the old breakwater ($24,000), and a little dredging ($5,000) along the western side of the old breakwater and also inside the harbor: all at a total cost estimated in 1888 at $75,000.

A plan of the works may be found at page 612, Annual Report of the Chief of Engineers for 1885, and page 844 of 1893; and further details at pages 609 and 613 of 1885 and page 506 of 1888.

Appropriations.—Upon the present project appropriations have been made as follows: 1886, $20,000; 1888, $15,000; 1890, $15,000; 1892, $24,000; 1894, $2,500. Total up to June 30, 1895, $76,500.

Amount expended and results up to June 30, 1894.—The total amount expended on the present project (including $422.82 outstanding liabilities) up to June 30, 1894, was $71,937.26, by which the gap in the old breakwater had been filled up so as to make the breakwater of 1,900 feet total length; the sea walls of the inner harbor had been completed (except as to stone fender piers at the entrance); wooden fender piers had been built for present uses, and the worst rocks and bowlders had been removed from the new inner harbor.

Operations during the past fiscal year.—Value of the United States plant, $2,226. Including $1,162.22 outstanding liabilities on June 30, 1895, the expenses of the year were $2,804.35.

In August a project was approved for the expenditure of the new appropriation of August 17, 1894; the dredging and all other work to be done by hired labor and the use of the Government plant. Minor surveys were made in March and May to serve as a basis for the coming season's work. In April (on account of the Government plant being in need of expensive repairs) informal bids were solicited for the small amount of needed dredging. By Department indorsement of May 3, 1895, $1,000 was authorized to be expended for dredging at the shoaled entrance to the inner harbor, and an agreement was made with the Hartford Dredging Company, of Hartford, Conn., under date of May 6, to do this work (about 3,000 cubic yards) at 33⅓ cents per cubic yard, measured in scows. By Department telegram of June 21, the above authority was extended to include the removal of 600 cubic yards of material, at the same rates, from the shoaled southwest portion of the inner basin. Under this agreement work was commenced on June 15, and 2,535 cubic yards of sand and gravel were removed from the entrance to the inner harbor to a depth of 12 feet at low water, and 318 cubic yards of mud and sand were removed from the shoaled southwest corner of the inner basin to a depth of 9 feet at low water, nearly completing all work proposed at this locality for the present. Further stonework and the general dredging of the harbor await further appropriations.

Lights have been maintained on the north sea wall during the year.

The dredging work was in the local charge of Mr. Edward Parrish as assistant engineer, with Mr. Percival Parrish as inspector, and the survey under Mr. J. H. Rostock as assistant engineer.

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PROGRESS MAP FOR 1895

HARBOR OF REFUGE

AT

BLOCK ISLAND, R.I.

FROM 1. JULY 1894 TO 30. JUNE 1895

ENLARGED INNER HARBOR

Scales

LENGTHS

100 0 200 400 600 800 FEET

DEPTHS & HEIGHTS

5 0 10 20 30 40 FEET

Based on maps of 1884-93 & map made 1895 under direction of Capt W.H. Bixby, Corps of Engrs U.S.A. by J. H. Rostock. Reduced and drawn by P. Brosig.

SHORE LINE AT M. H. W.

SHORE LINE AT M. L. W.

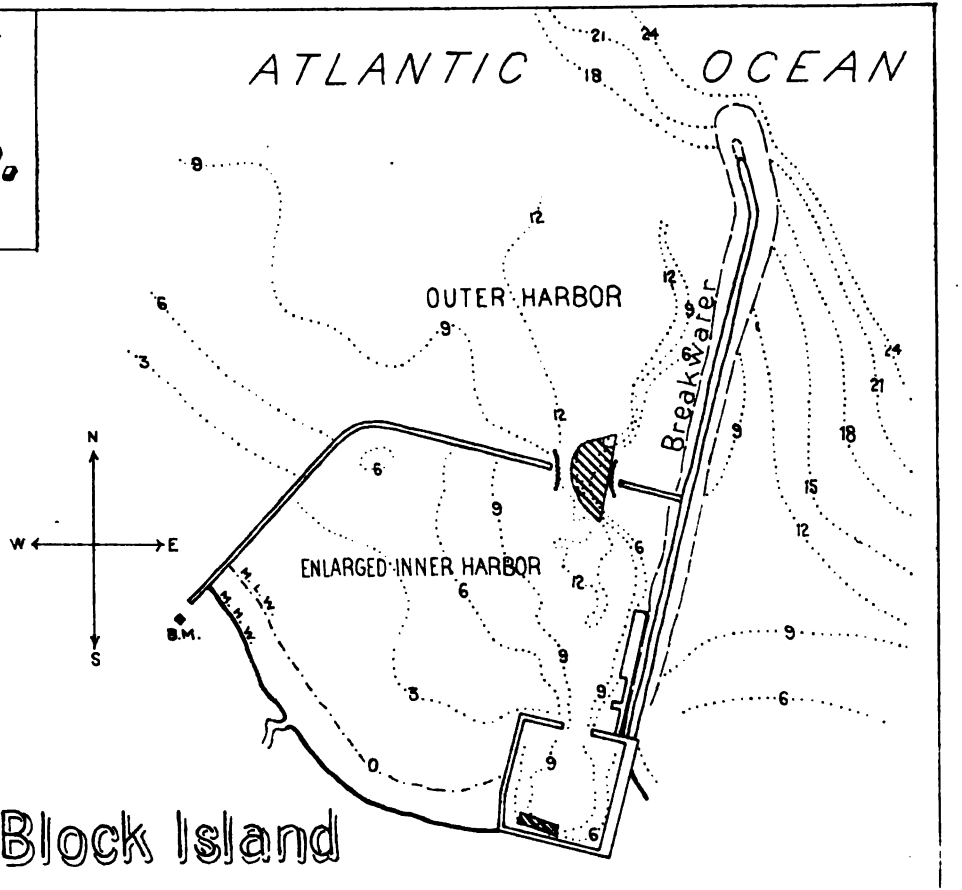
12 CONTOURS & DEPTHS (FEET) AT M.L.W.

B.M. BENCHMARK IS 20.66 FT. ABOVE M.L.W.

MEAN RISE AND FALL OF TIDE IS ABOUT 3.0 FT.

WALLS

DREDGING OF FISCAL YEAR 1894/95.



Newport, R.I. July 1895

Respectfully submitted

Wm W. Harts

1st. Lieut., Corps of Engineers, U.S.A.

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Work required to complete the existing project.—The work required to complete the existing project is the construction of stone pierheads, the strengthening of the weaker parts of the existing walls, and a little occasional dredging.

Operations contemplated for the fiscal year ending June 30, 1896.—It is proposed to complete the existing project.

Block Island is in the Newport collection district, and Newport is the nearest port of entry. The revenue collected in Newport in the last calendar year was $450.70. There is no duty collected at Block Island. The value of the harbor is mainly as a harbor of refuge. There are several lights at the island. The nearest fortification is Fort Adams, R. I.

Money statement.

July 1, 1894, balance unexpended	$2,485.56
Amount appropriated by act of August 17, 1894	2,500.00
	4,985.56
June 30, 1895, amount expended during fiscal year	2,064.95
July 1, 1895, balance unexpended	2,920.61
July 1, 1895, outstanding liabilities	1,162.22
July 1, 1895, balance available	1,758.39

COMMERCIAL STATISTICS.

The commerce arriving and leaving Block Island, R. I., by water during the calendar year ending December 31, 1894, is estimated as follows (based mainly upon reports received from Mr. C. C. Ball, Block Island, R. I.):

Class of goods.	Exports.	Imports.	Total.	
			Value.	Tons.
Cotton and products		$3,000	$3,000	5
Tobacco		20,000	20,000	30
Rice		1,800	1,800	10
Grains and forage	$450	26,600	27,050	1,050
Vegetables and truck	4,900	5,600	10,500	480
Live stock and products	46,500	156,510	203,010	1,100
Fish, oysters, etc	331,275	975	332,250	10,250
Naval stores		420	420	10
Lumber and products		102,300	102,300	4,100
Coal, minerals, and products		71,350	71,350	10,000
Fertilizers		4,550	4,550	130
General merchandise		434,425	434,425	7,000
Sundries	125,000	200,000	325,000	9,000
Total	508,125	1,027,530	1,535,655	43,165

Gain over last year, about 6,000 tons, or $500,000; new transportation companies established during the year, none.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam:			
Freight and passenger	800	7	450
Fishing	500	7.5	130
Tugs	175	7.5	130
Pleasure boats	700	7	130
Sail:			
Freight	265	9	150
Fishing boats	6,000	7	30
Oyster boats	300	6	30
Pleasure boats, large	1,000	8	15
Pleasure boats, small	65,000	5.5	5

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C 17.

IMPROVEMENT OF PAWCATUCK RIVER, RHODE ISLAND AND CONNECTICUT.

The navigable part of Pawcatuck River extends from the manufacturing town of Westerly to Little Narragansett Bay, into which it empties. The approach to the river is through Stonington Outer Harbor and Little Narragansett Bay, and the object of the improvement is to deepen and widen the river channel leading from this bay to Westerly.

The mean rise and fall of the tide is 2.6 feet at the mouth of the river and 2.3 feet at Westerly.

Original condition.—Before improvement the channel was narrow, crooked, and obstructed by numerous shoals, on some of which there was but 1½ feet at mean low water. (For map, see p. 314 of Annual Report of 1879.)

Between 1871 and 1876, $50,000 was appropriated for the excavation of a channel 5½ feet deep at mean low water, 75 feet wide below the wharves, and from 35 to 40 feet wide between the lower and upper wharves. This work was completed in 1876. (See p. 211 of Annual Report of 1876.)

At the adoption of the present project the channel was limited to 5.5 feet depth over 75 feet width below the city and the same depth over 35 feet width opposite the city, and rock ledges crossed the channel at several points.

Plan of improvement.—The present approved project, that of 1885, provides for the deepening and widening of the river so as to secure a channel of at least 8 feet depth at low water with 100 feet width from its mouth up to the lower wharves of Westerly, and thence a channel of the same depth with about 40 feet width up to the upper wharves of the city; all at a total cost estimated in 1891 at $42,400.

A plan of the works may be found at page 624, Annual Report of the Chief of Engineers for 1885, and page 845, of 1893; and further special information at page 634, of 1892.

Appropriations.—Upon the present project appropriations have been made as follows: 1886, $12,000; 1888, $10,000; 1890, $16,600; 1892, $3,800; 1894, $6,000. Total up to June 30, 1895, $48,400.

Amount expended and results to June 30, 1894.—The total amount expended on the present project (including $61.37 outstanding liabilities) up to June 30, 1894, was $41,295.29 by which the 8-foot depth channel had been completed from deep water upward for full width to within a half mile of the city, and for partial width for the remaining distance; and loose bowlders and ledge rocks had been removed from about 3,000 feet length of the 40-foot channel between the wharves of Westerly, and from about 1,000 feet length of the 100-foot channel below the city, leaving nothing of these obstructions above the general bottom of the dredged channel. A minor survey had been made to show the results of the past field work, and also to serve as a basis for future improvement.

Operations during the past fiscal year.—Value of the United States plant, $2,024. Including $2,140.12 outstanding liabilities on June 30, 1895, the expenses of the last fiscal year were $3,015.11.

In August, a project was approved for the expenditure of the new appropriation of August 17, 1894; the main work of dredging to be done by contract, but other work to be done by hired labor and the

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PROGRESS MAP FOR 1895

PAWCATUCK RIVER, R.I. & CONN.

FROM 1. JULY 1894 TO 30. JUNE 1895

CHANNEL

UPPER PART OF RIVER

FROM OLD SHIP YARD TO WESTERLY

Scale

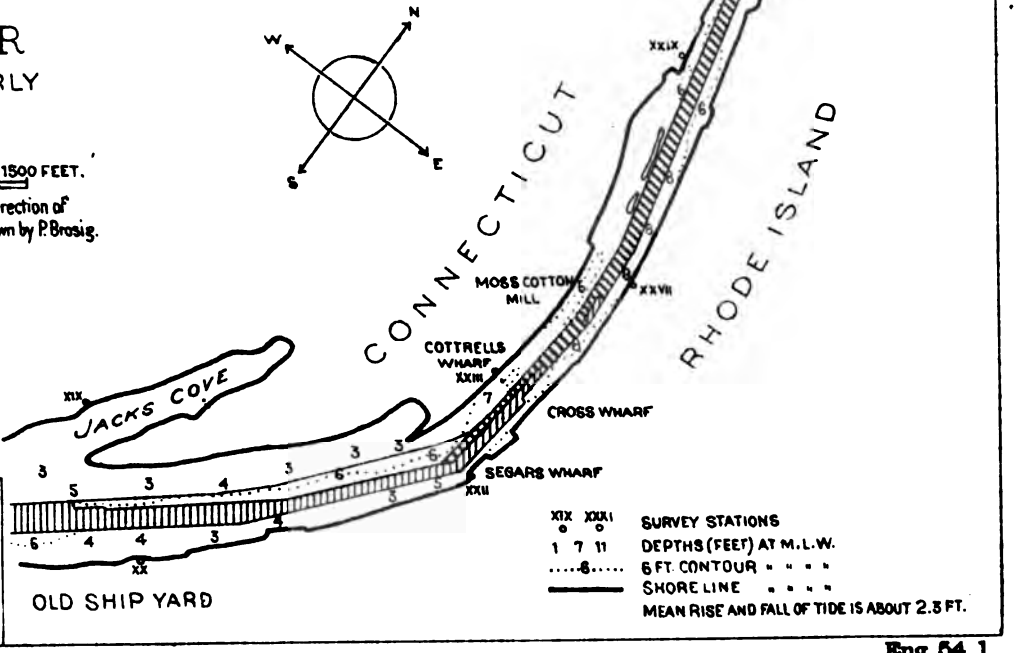
100 0 500 1000 1500 FEET.

Based on maps of 1887 & 1891 and map made 1893 under direction of Capt. W. H. Bixby, Corps of Engrs. U.S.A. by J. H. Rostock. Reduced & drawn by P. Brosig.

CHANNEL TO BE 8FT. DEEP AT M.L.W.

WORK DONE

- PRIOR TO JUNE 30. 1894
- DURING FISCAL YEAR 1894/95.
- UNCOMPLETED OR PROPOSED



Newport, R.I. *July 1895*

Respectfully submitted

Wm. W. Harts

1st Lieut., Corps of Engineers, U.S.A.

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purchase of materials in open market. Under this appropriation, bids for dredging were opened and the contract for about $4,000 worth of work was entered into with John H. Fenner, of Jersey City, N. J., under date of April 3, approved by the Chief of Engineers on April 12, 1895, at 29.5 cents per cubic yard; work to be commenced by July 1 and completed by October 1, 1895. Under this contract, actual work of dredging was commenced on May 25, and 6,548 cubic yards of sand, gravel, and small bowlders, together with 3.83 cubic yards of large bowlders were removed, completing a channel of 8 feet depth at low water and 40 feet width for a distance of 1,550 feet, and 20 feet width for an additional distance of 950 feet; all opposite the lower wharves of the city of Westerly.

The contract work was under the local charge of Mr. Edward Parrish as assistant engineer, with Mr. Samuel B. Pendleton and Mr. James Abbott as inspectors; and the survey was under Mr. J. H. Rostock as assistant engineer.

Work required to complete the existing project.—The work required to complete the existing project is the dredging of the channel to a depth of 8 feet at mean low water and full width of 100 feet over the half mile below Westerly, and a width of 40 feet between the upper and lower wharves of that town.

Operations contemplated for the fiscal year ending June 30, 1896.—It is proposed to complete the work.

Pawcatuck River is in the collection districts of Providence and Stonington, the dividing line passing through the river. Providence and Stonington are the nearest ports of entry. The revenue collected in the last calendar year was: Providence, $203,987.13; Stonington, $463.03. The nearest light-houses are the Stonington and Watch Hill lights. The nearest fortification is Fort Trumbull, New London, Conn.

Money statement.

July 1, 1894, balance unexpended		$1,166.08
Amount appropriated by act of August, 17, 1894		6,000.00
		7,166.08
June 30, 1895, amount expended during fiscal year		920.28
July 1, 1895, balance unexpended		6,245.80
July 1, 1895, outstanding liabilites	$2,140.12	
July 1, 1895, amount covered by uncompleted contracts	3,506.35	
		5,646.47
July 1, 1895, balance available		599.33

Abstract of proposals opened March 20, 1895, at Newport, R. I., by Capt. W. H. Bixby, U. S. Engineers, for dredging in the river at Pawcatuck, R. I.

[Quantity required, about $4,000 worth of work.]

No.	Name and address of bidder.	Price per cubic yard.	Remarks.
		Cents.	
1	John H. Fenner, Jersey City, N. J	29.5	Begin July 1, 1895.
2	Elijah Brainard, New York	45	Begin Mar. 1, 1896.

Contract awarded to John H. Fenner at 29.5 cents.

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COMMERCIAL STATISTICS.

The commerce arriving and leaving Pawcatuck River, Rhode Island, by water during the calendar year ending December 31, 1894, is estimated as follows (based mainly upon reports received from Messrs. Maxson & Co., Westerly, R. I.):

Class of goods.	Exports.	Imports.	Total.	
			Value.	Tons.
Grains and forage	.....	$18,000	$18,000	500
Lumber and products	.....	70,100	70,100	7,000
Coal, minerals, and products	.....	145,828	145,828	32,900
Stone	$147,000	.....	147,000	11,000
Sundries (sand, cement)	.....	1,285	1,285	1,405
Total	147,000	235,213	382,213	52,805

This list shows a large gain over last year in exports, and a slight loss in imports, and a total gain in tonnage of about 17,000 tons; new transportation companies established during the year, none reported.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam:			
Freight mainly	7	.....	.....
Passenger mainly	470	6	50
Tugs	620	6	50
Sail:			
Freight	175	8	.....
Fishing boats	60	.....	.....
Pleasure boats, large	95	3	.....
Pleasure boats, small	350	2	.....

Twenty vessels discharged at Stonington because of insufficient depth of water in the river.

C 18.

HARBOR OF REFUGE AT STONINGTON, CONNECTICUT.

Stonington Harbor lies on the north side of the eastern entrance from the ocean into Long Island Sound. The main object of the improvement is to furnish a harbor of refuge for vessels entering and leaving this entrance to the Sound. The mean rise and fall of the tide is about 2¾ feet.

Original condition.—Originally it was an open bay, unprotected from southerly storms, and obstructed by a shoal having a low-water depth of but 6 feet at the shoalest part. This shoal nearly filled the inner harbor, and left but a narrow channel on either side, of a depth insufficient to permit vessels of 12-foot draft to reach the upper wharves at low water.

Between 1827 and 1831 about $37,000 was spent in constructing piers or small breakwaters in the inner harbor for the protection of the anchorage. (See p. 326, Part I, Annual Report of 1879.)

Between 1871 and 1873 $46,166 was appropriated for a survey of the harbor and for dredging the harbor to 12 feet depth. This work was finished in 1875. (See p. 246, Part II, Annual Report of 1874.)

Between 1875 and 1879 $112,500 was appropriated for the construction of a western breakwater, running southeast 2,000 feet from Wampaset Point to 18 feet depth of water, and for dredging to 12 feet depth

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inside of this breakwater. (See pp. 243, 244, 245, Part II, Annual Report of 1875.) This work was completed in 1880.

At the adoption of the present project the harbor had no eastern breakwater.

Plan of improvement.—The present approved project, that of 1880, provides for the construction of an eastern breakwater as a protection to the outer harbor; this breakwater, about a half mile long, to extend from the vicinity of Bartlett Reef to the vicinity of the Middle Ground Shoal, or until it gives sufficient protection to the harbor against southerly winds; all at a total cost, estimated in 1884, at $143,000 to $191,000, according to the length to be given to the breakwater; both estimates to be increased later by the cost of a light-house foundation on the end of the finished jetty.

A plan of the works may be found at page 598, Annual Report of the Chief of Engineers for 1882; page 632, of 1884; page 848, of 1893, and further information at page 585, of 1881.

The position of the ends of the eastern breakwater has not yet been definitely determined, but it will probably be found necessary, in order to afford all the protection desired, to extend the breakwater at its eastern end to Bartlett Reef, and at its western end until it intersects a range from the end of the western breakwater to the middle of Wicopessit Island, so as to thoroughly shelter the harbor from southerly storms.

Appropriations.—Upon the present project appropriations have been made as follows: 1880, $25,000; 1881, $30,000; 1882, $25,000; 1884, $10,000; 1886, $20,000; 1888, $8,000; 1890, $12,500; 1892, $12,500; 1894, $5,000. Total, up to June 30, 1895, $148,000.

Amount expended and results to June 30, 1894.—The total amount expended on the present project (including $249.26 outstanding liabilities), up to June 30, 1894, was $132,578.59, by which this breakwater had been built to full height and 2,377 feet length, leaving only a few hundred feet more length to be built to complete the project.

Operations during the past fiscal year.—Value of United States plant, $1,031. Including $153.06 outstanding liabilities on June 30, 1895, the expenses of the year were $10,541.32.

Bids for the stonework under the 1892 appropriations were received, and the contract awarded to S. & E. S. Belden, of Hartford, Conn., at $1.03 per ton of 2,000 pounds for about $8,000 worth of work, to be commenced on or before August 15, and completed on or before December 15, 1894; actual work having been commenced on August 24, and about 7,789 tons of stone having been towed to the place of work, of which about 1,963 tons of core and 5,730 tons of facing stone were deposited in the 600-foot extension to the breakwater, completing all work under this contract in November, and extending the breakwater to a total length of nearly 3,000 feet. In August a project was approved for the expenditure of the new appropriation of August 17, 1894, the main work of dredging to be done by contract, but other work to be done by hired labor and the purchase of materials in open market. A preliminary survey was made in April to determine the amount of needed dredging on Noyes Shoal and in the harbor. A subproject, based on the recent survey, for dredging a channel across Noyes Shoal was submitted and approved in May. Bids have been invited for about $3,000 worth of dredging, to be opened in July, 1895.

A light has been maintained upon the end of the eastern breakwater during the year. The contract work was in the local charge of Mr. Edward Parrish as assistant engineer, with Mr. Samuel B. Pendleton

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as inspector, and the survey was under charge of Mr. J. H. Rostock as assistant engineer.

Work required to complete the existing project.—The work required to complete the existing project is the extension of the eastern breakwater perhaps 600 feet at its eastern end and about 700 feet at its western end.

Operations contemplated for the fiscal year ending June 30, 1896.—With the present available funds it is proposed to dredge the channel across Noyes Shoal.

Stonington Harbor is in the Stonington collection district and is a port of entry. The amount of revenue collected at Stonington in the last calendar year was $463.03. The principal value of the harbor is as a harbor of refuge. The nearest lights are Stonington Light and Latimer Reef Light. The nearest fortification is Fort Trumbull, New London Harbor, Connecticut.

Money statement.

July 1, 1894, balance unexpended	$10,670.67
Amount appropriated by act of August 17, 1894	5,000.00
	15,670.67
June 30, 1895, amount expended during fiscal year	10,637.52
July 1, 1895, balance unexpended	5,033.15
July 1, 1895, outstanding liabilities	153.06
July 1, 1895, balance available	4,880.09

Abstract of proposals opened July 17, 1894, at Newport, R. I., by Capt. W. H. Bixby, U. S. Engineers, for supplying and placing stone in the breakwater at Stonington, Conn.

[Quantity required, about $8,000 worth of work.]

No.	Name and address of bidder.	Price per ton.	
		Core stone.	Facing stone.
1	Daniel Toomey, Guilford, Conn	$0.98	$0.98
2	S. & E. S. Belden, Hartford, Conn	1.03	1.03
3	George W. Andrews, Biddeford, Me	1.15	1.15
4	John Salter & Son, Groton, Conn	1.25	1.25
5	William H. Molthrop & Co., New London, Conn	1.13	1.13

Contract awarded to S. & E. S. Belden at $1.03 per ton.

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Stonington Harbor, Connecticut, by water during the calender year ending December 31, 1894, is estimated as follows (based mainly upon reports received from Mr. C. T. Stanton, collector of customs, Stonington, Conn., and others):

Class of goods.	Exports.	Imports.	Total.	
			Value.	Tons.
Stone		$40,000	$40,000	20,000
Grains and forage		21,600	21,600	900
Fish, oysters, etc	$9,000		9,000	150
Lumber and products		77,500	77,500	6,560
Coal, minerals, and products		300,000	300,000	62,600
Fertilizers		5,600	5,600	160
General merchandise	23,000,000	22,221,130	45,221,130	204,500
Sundries	66,000	70,000	136,000	5,000
Total	23,075,000	22,735,830	45,810,830	299,870

Gain over last year, nothing special; new transportation companies established during the year, none.

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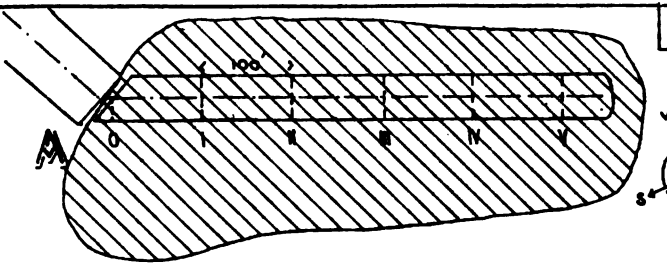
PROGRESS MAP FOR 1895
HARBOR OF REFUGE
AT
STONINGTON, CONN.

FROM 1. JULY 1894 TO 30. JUNE 1895

SHEET 1.



EASTERN BREAKWATER

Scales

LENGTHS

100 50 0 100 200 300 FEET

WIDTHS

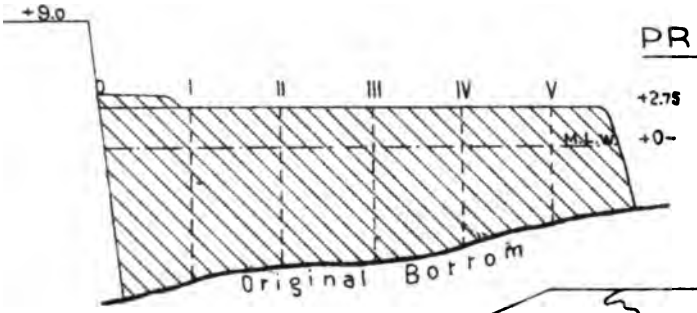
10 5 0 10 FT.

DEPTHS & HEIGHTS

10 5 0 10 FT.

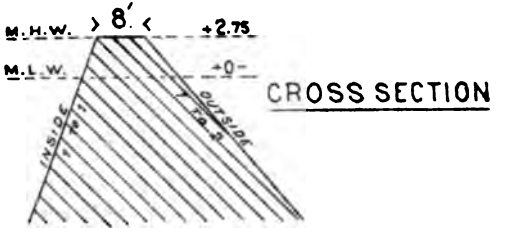
From surveys made under direction of Capt. W.H. Bixby, Corps of Engrs. U.S.A. by J.H. Rostock 1894 Drawn by P. Brosig.

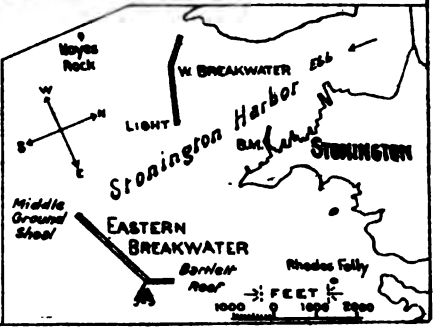
B.M. BENCHMARK IS 8.68 FT. ABOVE M.L.W.
MEAN RISE AND FALL OF TIDE IS 2.75 FT.



— WORK DONE —

DURING FISCAL YEAR 1894/95.





Newport, R.I. *July 1895*

Respectfully submitted

Wm. M. Harts

1st. Lieut. Corps of Engineers, U.S.A.

Fig 64 1

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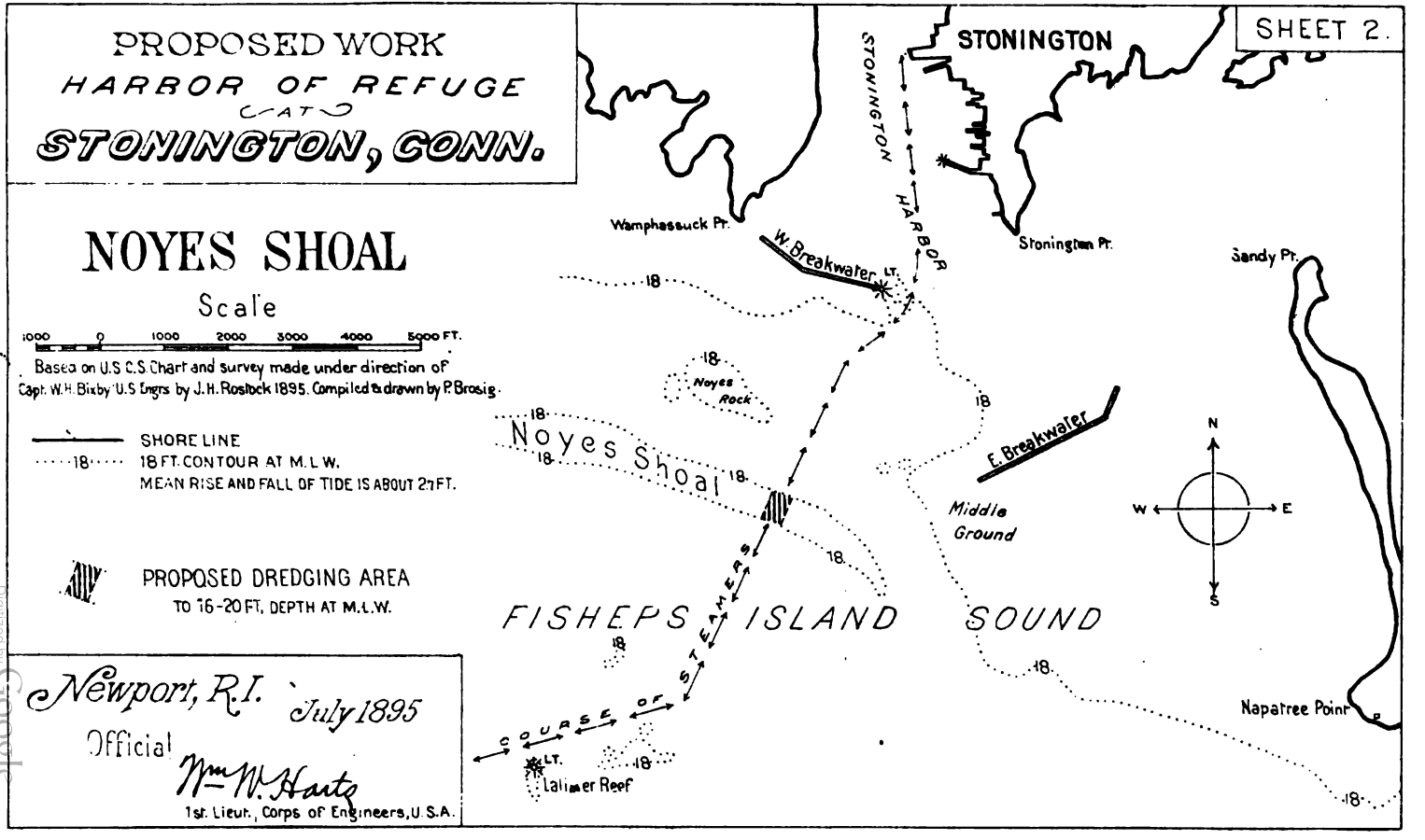
PROPOSED WORK
HARBOR OF REFUGE
AT
STONINGTON, CONN.
SHEET 2.
NOYES SHOAL
Scale
1000 0 1000 2000 3000 4000 5000 FT.
Based on U.S.C.S. Chart and survey made under direction of Capt. W.H. Bixby U.S Engrs by J.H. Rosbock 1895. Compiled & drawn by P. Brosig.
SHORE LINE
18 18 FT. CONTOUR AT M.L.W.
MEAN RISE AND FALL OF TIDE IS ABOUT 2.7 FT.
PROPOSED DREDGING AREA
TO 16-20 FT. DEPTH AT M.L.W.
Newport, R.I. July 1895
Official
Wm. W. Haute
1st. Lieut., Corps of Engineers, U.S.A.
STONINGTON
STONINGTON HARBOR
Wamphassuck Pt.
W. Breakwater LT.
Stonington Pt.
Sandy Pt.
Noyes Rock
Noyes Shoal
E. Breakwater
Middle Ground
N
W
E
S
FISHERS ISLAND SOUND
COURSE OF STEAMERS
LT.
Latimer Reef
Napatree Point
18

Eng 54 1

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The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam:			
Freight and passenger	425	12	1,500
Freight mainly	38	10	1,000
Fishing	38	6	25
Tugs	200	6	30
Sail:			
Freight	1,000	10	150
Fishing boats	500	6	25
Pleasure boats, small	1,000	25	.....

C 19.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

1. WRECK NEAR BROWNS LEDGE, MASSACHUSETTS.

An unknown wreck near Browns Ledge, Massachusetts, was on May 9, 1894, reported to your office as then lying sunk somewhere within an area of about one mile diameter, in location from 2.5 to 3.5 miles north of Browns Ledge, western entrance to Vineyard Sound, Massachusetts, and as therefore being a dangerous obstruction to the free navigation of the neighborhood. Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by approval of the Secretary of War and of the Chief of Engineers, of May 12, 1894, the work of the removal of this wreck was authorized, and $200 was allotted for this purpose, work to be done by hired labor and the use of the Government plant.

According to the latest information, nothing definite is known as to the identity of this wreck other than between November, 1893, and May, 1894, various reports continued to be heard as to an unknown wreck whose mast or spar projected from 3 to 8 feet above the water somewhere within the area above mentioned, and in from 12 to 16 fathoms of water, and from 7 to 8 miles from the nearest shores, that of Seaconnet Point on the west and Cuttyhunk on the east. As the wreck evidently lay where she was liable to be struck by craft using this neighborhood, it was thought best that her masts and rigging be removed down to 30 feet depth below low-water level, to prevent her from endangering and obstructing navigation.

While preparations were being made to locate this wreck, and before the engineer force and plant could be spared from other work and sent to this locality, further report was received from the Navy Department that its dynamite cruiser *Vesuvius* had found this wreck on or about May 1 and destroyed its masts and rigging to about 60 feet depth, leaving nothing further to be done.

No final inspection of the work done by the *Vesuvius* could be made by this office, owing to the absence of any knowledge of its location sufficiently accurate as to allow its exact position to be again found. The final report on this wreck was delayed until November 30, 1894, in order that the wreck's removal should be confirmed by the absence of further complaints as to such obstruction at that locality. No such further complaints having been heard of by this office, this wreck is believed to be no longer an obstruction to the navigation of this locality.

The total cost of this work (office work only) was $8.34.

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The unused funds have been returned to the United States Treasury in accordance with the provisions of the special act and section above quoted.

2. WRECK OF SCHOONER L. H. HOPKINS.

The schooner *L. H. Hopkins* was in May, 1894, reported to your office as then lying sunk across the main channel of the Pawtucket River, Rhode Island, and as therefore being a dangerous obstruction to the free navigation of the neighborhood. This wreck had been complained of and requests for her removal had been made by the mayor of Pawtucket, R. I., and the prominent steamer and coal agents of that city. Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by approval of the Secretary of War of May 29, 1894, and of the Chief of Engineers of June 1, 1894, the work of the removal of this wreck was authorized, and $600 was allotted for this purpose; work to be done by hired labor and the use of the Government plant.

According to the latest information this vessel at the time of wrecking, on May 16, 1894, was loaded with paving stone, and while being hauled away from the wharves (in order to escape from adjacent burning buildings) she caught on fire and sank in a position directly across the channel of the river (which at this place is only about 50 feet wide) and in from 8 to 11 feet of water at a point about 400 feet below the Division Street Bridge. She was a one-decked, three-masted schooner of 109 feet length, 30 feet breadth, 10 feet depth, 232 tons gross, tonnage, built in 1865 at Barnegat, N. J., documented from New York, N. Y., and owned by S. E. Birdsall.

As the wreck obstructed the navigation of the upper portion of the river containing the principal steamboat and coal wharves of the city, it was a specially objectionable obstruction, and as the usual two months' delay required by the United States laws prior to the removal of a wreck under such laws, would cause a very great loss to the commerce of the city of Pawtucket, Captain Bixby furnished the mayor of Pawtucket, the harbor commissioners, and the governor of the State of Rhode Island, and other persons immediately interested, with copies of the Massachusetts State laws as to the removal of such wrecks, and suggested the enactment of similar legislation by the State of Rhode Island. This resulted in the immediate passage, by the general assembly, then in session, of a law allowing immediate action by the State harbor commissioners in all such cases, this law not only affording immediate relief to an obstructed navigation, but at the same time rendering unnecessary any hasty action by the United States. As such a law might be of equal value to other States, it is here given in full, as follows:

STATE OF RHODE ISLAND.

CHAPTER 1318.

AN ACT in amendment of and in addition to chapter 100 of the Public Statutes, entitled "Of the protection of navigation."

It is enacted by the general assembly as follows:

SECTION 1. Whenever a wrecked, sunken, or abandoned vessel, or any unlawful or unauthorized structure or thing is deposited or suffered to be or remain in the tide waters of this State, and in the judgment of the board of harbor commissioners is or is liable to cause or become an obstruction to the safe and convenient use of such waters for navigation and other lawful purposes, it shall be the duty of said board, and said board shall have power, to remove such obstruction, or cause the same to be removed, in accordance with the provisions of this act.

SEC. 2. If any person resident or being in the United States is known to said board as the owner of such vessel, or any interest therein, or as having or exercising any control of the same as master, agent, insurer, or otherwise, or, in case of

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any other unlawful or unauthorized obstruction, as having alone or with others built, deposited, or caused the same, or as owning, maintaining, or using the same in whole or in part, said board shall give notice in writing to such owner or other person to remove such vessel or other obstruction at or within a time specified in the notice. It shall be deemed a sufficient notice to all such owners and other persons if served upon any one or more of them by said board, or by its order, by delivering the same in hand or by leaving it at the usual place of business, residence, or abode, or by duly mailing it to the post-office address of the owner or other person on whom such notice is to be served.

SEC. 3. If such vessel or other obstruction is not removed at or within the time specified in such notice, and in a manner and to a place satisfactory to said board, or if such owner or other person is known to said board upon whom such notice can be served, said board may proceed to remove such vessel or other obstruction, or to complete the removal thereof, or to cause the same to be done in such manner and to such place as said board shall deem best, and the necessary cost and expense of such removal, if not paid by some owner or other person liable therefor, shall, when certified by said board and approved by the governor, be paid out of the treasury of the State.

SEC. 4. The owner of any vessel, or of an interest in any vessel, willfully or maliciously wrecked, sunken, or abandoned as aforesaid, and removed as hereinbefore provided, whether owning at the time such vessel first became an obstruction, or at any subsequent time before such removal is completed, and all persons having or exercising any control over such vessel or any part thereof, and, in the case of any other obstruction so removed, the person or persons originally building, depositing, or causing the same, or at the time of such removal, or at any time prior thereto, owning, maintaining, or using the same in whole or in part, shall be liable to pay the cost and expenses of such removal, or to repay the same when paid out of the treasury as aforesaid; and the same may be recovered in an action of contract brought by said board in the name of the State against such owners or other persons, or against any one or more of them. The attorney-general shall conduct and commence such suits. All moneys so repaid or recovered shall be paid into the treasury of the State. Any person who pays on a judgment or otherwise more than his proportional part of the costs and expenses aforesaid, shall have a claim for contribution against all other parties liable therefor according to their respective interests.

SEC. 5. If the cost and expenses of removing a vessel or other obstruction as aforesaid are not paid or repaid by some owner or other person liable therefor within ten days after such removal is completed, said board of harbor commissioners may sell such vessel or other obstruction, or the materials and appurtenances thereof, at public or private sale, and the net proceeds of such sale shall be paid into the treasury of the State and deducted from the amount to be repaid or recovered as provided in the preceding section.

SEC. 6. No insurer of a vessel who has paid the loss thereon shall, by reason of such insurance, be held liable to remove such vessel, or to pay the cost and expenses of such removal, under the provisions of this act, unless such insurer has exercised some act of ownership or control over such vessel or some part or appurtenances thereof, or received the proceeds of the sale thereof.

SEC. 7. A commissioner of wrecks and shipwrecked goods shall not be liable to the provisions of this act by reason of anything done by him in discharge of his office as such commissioner, but he shall, upon notice and request by said board of harbor commissioners, retain and apply so much of the property in his possession appertaining to a wrecked vessel, or of the proceeds thereof, as may be necessary to provide for the removal of such vessel so that the same shall not be an obstruction in tide waters.

SEC. 8. It shall be the duty of commissioners of wrecks and shipwrecked goods, and of harbor masters, to give immediate notice to the board of harbor commissioners of all shipwrecks occurring in tide waters of their respective towns and harbors and of any obstructions existing therein.

SEC. 9. There shall be allowed and paid out of the treasury annually a sum not exceeding three thousand dollars, to be expended as may be necessary in carrying out the provisions of this act.

* * * * * * *

SEC. 11. This act shall take effect upon its passage.

* * * * * * *

I certify the foregoing to be true copies.
Attest:

CHARLES P. BENNETT,
Secretary of State.

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Under the provisions of the above law and the permission of the harbor commissioners the wreck, with its cargo, was entirely removed from the channel of the river by private parties during the month of June, 1894. At the end of the two months' limit the statements of the harbor commissioners showed that the wreck was no longer an obstruction to navigation. No special inspection was therefore made at that time by the U. S. Engineer Office, but final reports were held back until November 30, 1894, to allow of further reports, if any, by any parties interested. No complaints having been received, it was then assumed that the wreck had been fully removed. Subsequent inspections (in connection with other channel work at this place) confirmed the earlier conclusions. This wreck is therefore believed to be no longer an obstruction to the navigation of this locality.

The total cost of this work (office work only) was $13.83.

The unused funds have been returned to the United States Treasury in accordance with the provisions of the special act and section above quoted.

3. WRECK NEAR PARKERS RIVER, MASSACHUSETTS.

An unknown wreck was in June, 1894, reported to your office as then lying sunk outside of Parkers River, Massachusetts, in Buzzards Bay, and as therefore being a dangerous obstruction to the free navigation of the neighborhood. Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by approval of the Chief of Engineers of July 19, 1894, the work of the removal of this wreck was authorized, and $400 was allotted for this purpose, work to be done by hired labor and the use of the Government plant.

According to the latest information, this vessel was named the *White Foam;* and at the time when originally wrecked, about eight years ago, was loaded with coal, and sank in about 8 feet of water at a point about 2 miles southwest by south from the Bass River Breakwater, and about 0.5 mile from the nearest shore, that of the mouth of Parkers River. She was a wooden schooner and approximately of about 65 feet length, 18 feet breadth, 8 feet depth, and 60 tons gross tonnage. Examinations of the wreck, made on August 27, 1894, showed her to be in the above location, her bow, stern, and sides still standing, and with 2 feet depth of water over her and 8 feet depth of water around her. Since sinking, she had been run into several times (by at least three boats in the past two years) with considerable injury to the boats and great risk to the lives of the occupants. As the wreck still lay where she was liable to be struck by the light-draft vessels using this neighborhood, it was thought best that all remaining portions should be removed down to the level of the surrounding ocean bottom, to prevent her from endangering and obstructing navigation. The location of the wreck at that time is shown by sketches and maps now on file in this Newport office.

Field work upon this wreck was commenced on August 27, 1894, under Mr. Theo. McMahan as diver and inspector, using a small hired sailboat and crew, and was completed on September 3, 1894. The actual underwater work was done in five days; two other days being lost to this wreck on account of the wrecking party being more advantageously employed on a much more dangerous wreck near by. The remaining portions of the wreck were shattered by 185 pounds of dynamite, in 43 charges of from 3 to 5 pounds each, by which the projecting portions and cargo were removed, a greater part of the wreckage floating away and the rest being scattered over the ocean bottom in such way that nothing was left projecting above the bottom.

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A final inspection, made on September 3, showed least depths of from 7.5 to 8 feet of water over the area previously occupied by the wreck; this being as much as exists over the adjacent parts of the surrounding shoal. This wreck is therefore no longer an obstruction to the navigation of this locality.

No property of any value was recovered; nor was any attempt made to save any, since the cost of such work would have been greater than the value of the material saved (either through the direct expense of such work or the delay thereby caused to the main work of destruction of the wreck itself).

The total cost of this work was $303.49, including all expenses of first examination, subsequent and final inspection, and other superintendence in the field and office.

The unused funds have been returned to the United States Treasury in accordance with the provisions of the special act and section above quoted.

4. WRECK OF BARGE SHAMOKIN.

The barge *Shamokin* was on July 13, 1894, reported to your office as then lying sunk in Pollock Rip Slough, and as therefore being a dangerous obstruction to the free navigation of the neighborhood. Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by approval of the Secretary of War of July 23, 1894, and of the Chief of Engineers of July 24, 1894, the work of the removal of this wreck was authorized, and $800 was allotted for this purpose, work to be done by hired labor and the use of the Government plant.

According to the latest information, this vessel at the time when originally wrecked, on June 26, 1894, was loaded with coal; was on her way from Philadelphia, Pa., to Newburyport, Mass., was run into by a steamer during a dense fog, and sank in about 42 feet of water at a point about 250 yards southeast of the Pollock Rip Light-ship, and about 3.5 miles from the nearest shore, that of Monomoy Point, Massachusetts. She was a single-decked, two-masted wooden sloop-barge, of 187 feet length, 35 feet breadth, 16 feet depth, 841 tons gross tonnage, built in 1890, at Perth Amboy, N. J., documented from Philadelphia, Pa., and owned by Mr. Asa S. Wing. Examinations of the wreck, made on August 31, showed her masts to have disappeared but her hull and cargo to be still intact with the exception of a small hole in her port side; and soundings showed 15 feet of water over her deck and 42 feet of water all around her. As the wreck lay where she was a constant danger to the vessels having to use this waterway, it was thought best that her hull be removed down to 28 feet depth below low-water level to prevent her from endangering and obstructing navigation. The location of the wreck at that time is shown by sketches and maps now on file in this Newport office.

Field work upon this wreck was commenced on August 31, under Mr. Theodore McMahan as diver and inspector, using a small hired sailboat and crew, and completed on September 23. The actual under-water work was done in eleven days, four days being lost on account of bad weather. The hull, deck, and cargo, which were found to be all there, were shattered by 1,161 pounds of dynamite, in 110 charges of from 7 to 11 pounds each, by which the upper portions of the wreck and cargo were removed, a part of the wreckage floating away, and the rest being scattered over the ocean bottom in deep water below the reach of vessels.

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A final inspection, made on September 23, showed least depths of from 28 to 37 feet of water over any remaining portions of the wreck. This wreck is therefore no longer an obstruction to the navigation of this locality.

No property of any value was recovered; nor was any attempt made to save any, since the cost of such work would have been greater than the value of the material saved (either through the direct expense of such work or the delay thereby caused to the main work of destruction of the wreck itself).

The total cost of this work was $796.32, including all expenses of first examination, subsequent and final inspection, and other superintendence in the field and office.

The unused funds have been returned to the United States Treasury in accordance with the provisions of the special act and section above quoted.

5. WRECK AT WOODS HOLE, MASSACHUSETTS.

A portion of an old wreck (name unknown) was on September 14, 1894, reported to your office as then lying sunk in Woods Hole Harbor, Massachusetts, and as therefore being a dangerous obstruction to the free navigation to the neighborhood. Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by approval of the Chief of Engineers of September 14, 1894, the work of the removal of this wreck was authorized, and $100 was allotted for this purpose; work to be done by hired labor and the use of the Government plant.

No accurate information could be obtained as to the identity or original occurrence of this wreck, but she is known to have lain in her late position for the past eight years, and is currently reported to have been towed there in a sinking condition, stripped of everything of value and then abandoned, so as to lie sunk in from 9 to 14 feet of water at a point about 200 feet northwest of the U. S. Revenue Marine Wharf, and about 200 feet southwest of the small boat wharf in front of the Breakwater Hotel. She was originally a wooden vessel of probably about 200 tons gross tonnage. Examinations of the wreck, made on September 17, showed the port side and a portion of the starboard side of a vessel from which projected some old bits and ironwork, the whole about 100 feet long, with from 2 to 8 feet of water over her, and with 9 to 14 feet of water all around her. As the wreck still lay where she was liable to be struck by boats using the harbor, and particularly by the light-house vessels and revenue marine steamers using the adjacent wharf (her solidity and height being sufficient to easily injure either of these boats), it was thought best that she should be completely broken up and removed to prevent her from endangering and obstructing navigation. The location of the wreck at the time is shown by sketches and maps now on file in this (Newport) office.

Field work upon this wreck was commenced on September 17, 1894, under Mr. Theodore McMahan, as diver and inspector, using a small hired sailboat and crew, and completed on September 18, 1894. The wreck was shattered by 100 pounds of dynamite in 26 charges, by which all projecting portions were removed, a part of the wreckage floating away, and the rest being hauled up on the beach above high water.

A final inspection, made on September 18, showed least depths of from 8 to 14 feet of water over the area previously occupied by the wreck, equal to that over the adjoining harbor bottom. This wreck is therefore no longer an obstruction to the navigation of this locality.

No property of any value was found worth saving.

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The total cost of this work was $61.16, including all expenses of first examination, subsequent and final inspection, and all other superintendence in the field and office.

The unused funds have been returned to the United States Treasury in accordance with the provisions of the special act and section above quoted.

6. WRECK AT BUZZARDS BAY, MASSACHUSETTS.

A portion of a wrecked vessel (name unknown) was on September 13, 1894, reported to your office as then adrift in Buzzards Bay, and as therefore being a dangerous obstruction to the free navigation of the neighborhood. Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by approval of the Chief of Engineers of September 13, 1894, the work of the removal of this wreck was authorized, and $100 was allotted for this purpose; work to be done by hired labor and the use of the Government plant.

According to the latest information, this piece of wreckage had been seen afloat in various parts of Vineyard Sound and Buzzards Bay during the fore part of September, and on September 13 was reported as having grounded in 12 feet of water at a point 100 yards from the shore of Naushon Island, west of the entrance to Woods Hole. It is supposed that it was a part of the wrecked schooner *Golden Rule*, which, while still afloat south of Nantucket, was on August 3 rammed and cut into two or more parts by the U. S. cruiser *Atlanta*, the various floating remnants of such wreck having been later reported as seen at varying intervals of time at various points on a natural route of travel along the south of Nantucket and Marthas Vineyard, and also in the mouth of Vineyard Sound, Seaconnet River, and Buzzards Bay, and temporarily ashore at Gay Head and other points. The *Golden Rule* was a British schooner of about 199 tons, which, loaded with molasses and on her way from Puerto Rico to Boston was, early in July, in a fog, run into and cut down to the water's edge by the steamer *Chattahoochee* in the neighborhood of Nantucket, New South Shoal, south of Nantucket. Examinations of the piece of wreckage at Naushon, made on the 13th and 16th of September, showed that the latter was composed of the starboard side of a comparatively new vessel, and was about 92 feet long, 22 feet wide, 2 feet thick, rising with the knees from 4 to 8 feet higher, with about 2 feet of water over the middle portion, and temporarily anchored by its rigging in 12 feet of water. The appearance of this wreckage was in harmony with the rumor as to its being one side of the *Golden Rule*. As the wreckage still lay where it was liable to float off and be struck by passing steamers and other craft using this neighborhood it was thought best that it should be completely removed to prevent it from further endangering and obstructing navigation. The location of the wreckage at that time is shown by sketches and maps now on file in this (Newport) office.

Field work upon this wreckage was commenced on September 16, under Mr. Theodore McMahan, as diver and inspector, using a small hired sailboat and crew, and was completed on the same day. The wreckage (the knees and waist timbers particularly), which was found to be quite firm and solid, was shattered by 156 pounds of dynamite in 42 charges, a large part of it floating away, the largest pieces being hauled up on the beach above high water, and the rest scattered over the bottom in such way that nothing was left projecting above the bottom.

A final inspection, made on September 16, showed a least depth of 12 feet of water over the area formerly occupied by the wreckage, this

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being as much as over the adjacent bottom. This wreckage is therefore no longer an obstruction to the navigation of this locality.

No property of any value was recovered, nor was any attempt made to save any, since the cost of such work would have been greater than the value of the material saved (either through the direct expense of such work or the delay thereby caused to the main work of destruction of the wreck itself).

The total cost of this work was $95.37, including all expenses of first examination, subsequent and final inspection, and other superintendence in the field and office.

The unused funds have been returned to the United States Treasury in accordance with the provisions of the special act and section above quoted.

7. WRECK OF SCHOONER DORA M. FRENCH.

The schooner *Dora M. French* was on September 18, 1894, reported to your office as then lying sunk in the western entrance to Vineyard Sound, and as therefore being a dangerous obstruction to the free navigation of the neighborhood. Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by approval of the Secretary of War and of the Chief of Engineers of September 21, 1894, the work of the removal of this wreck was authorized, and $300 was allotted for this purpose; work to be done by hired labor and the use of the Government plant.

According to the latest information this vessel at the time when originally wrecked, on September 10, 1894, was loaded with coal, was on her way from Hoboken, N. J., to Boston, Mass., was run into by the steamer *Portia* and sank in about 57 feet of water at a point about 2 miles east of the Vineyard Sound Light-Ship, 2.75 miles southwest by west of the Cuttyhunk Life-Saving Station, and about 1.5 miles from the nearest shore, that of the southwest bluff at Cuttyhunk. She was a 1-decked, 3-masted schooner of 113 feet length, 29 feet breadth, 9 feet depth, 215 tons gross tonnage, built in 1874 at Brewer, Me., documented from Bangor, Me., and owned by J. S. Jenness. Examinations of the wreck, made on the 1st and 2d of November at the time her exact location was determined, showed her spars projecting about 6 feet above the water, and near them the jaws of one of her booms, while some 400 feet away was what appeared to be a jib boom projecting about 10 feet above the water. As the wreck, though lying in deep water, still lay where the masts and rigging were liable to be struck by all craft using this much-frequented highway, it was thought best that such remaining masts and rigging be removed down to at least 30 feet below low water level to prevent her from endangering and obstructing navigation. The location of the wreck at that time is shown by sketches and maps now on file in this (Newport) office.

Field work upon this wreck was commenced on December 1, 1894, under Mr. E. Parrish, as assistant engineer, and Mr. Theodore McMahan, as diver and inspector, using a small hired sailboat and crew, and completed on the same day. By this date the heavy seas and tide had practically broken up the vessel, or at least detached portions of the rigging from the hull. All that could be found was two spars anchored by wire stays standing above the water to a height of about 12 feet, and they were shattered by 10 pounds of dynamite in 2 charges, and were removed; a large part of the wreckage floating away, and the rest sinking in deep water below the reach of vessels.

A final examination, made on the same day, showed a least depth of 57 feet of water over and around the place where the wreck was first

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located and also around where the spars were found. Diligent search was made for the other portions of this wreck by reaching and sweeping over an area of 2 miles, but nothing more was found. This wreck is therefore considered as no longer an obstruction to the navigation of this locality.

No property of any value was recovered, nor was any attempt made to save any, since the cost of such work would have been greater than the value of the material saved (either through the direct expense of such work or the delay thereby caused to the main work of destruction of the wreck itself).

The total cost of this work was $299.14, including all expenses of first examination, subsequent and final inspection, and other superintendence in the field and office.

The unused funds have been returned to the United States Treasury, in accordance with the provisions of the special act and section above quoted.

8. WRECK OF SCHOONER MARY J. CASTNER.

The schooner *Mary J. Castner* was on September 17, 1894, reported to your office as then lying sunk in Pollock Rip Slough, and as therefore being a dangerous obstruction to the free navigation of the neighborhood. Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by approval of the Secretary of War of September 22, 1894, and of the Chief of Engineers of September 24, 1894, the work of the removal of this wreck was authorized, and $1,000 was allotted for this purpose, work to be done by hired labor and the use of the Government plant.

According to the latest information, this vessel at the time when originally wrecked, on September 5, 1894, was loaded with iron; was on her way from North Weymouth, Mass., to Philadelphia, Pa.; was run into while at anchor and during a dense fog by schooner *Wm. K. Park*, and sank in about 30 feet of water at a point about 3 miles northeast of the bell buoy at Pollock Rip, also about 2.5 miles south-southeast of the Chatham Life-Saving Station, and about 1.75 miles from the nearest shore, that of Chatham Beach. She was a two-decked, three-masted schooner of 127 feet length, 32 feet breadth, 14 feet depth, 433 tons gross tonnage, built in 1877 at Bath, Me., documented from Philadelphia, Pa., and owned by Henry D. May & Co. Examinations of the wreck, made on the 12th and 13th of September, showed two of her masts, her jib boom, and bowsprit still standing and with from 18 to 27 feet depth of water over her, and from 27 to 35 feet depth of water around her. As the wreck still lay where she was liable to be struck by all craft using this public and much-frequented highway, it was thought best that her masts and hull be removed down to at least 28 feet depth below low-water level, to prevent her from endangering and obstructing navigation. The location of the wreck at that time is shown by sketches and maps now on file in this (Newport) office.

Field work upon this wreck was commenced on November 12, under Mr. E. Parrish as assistant engineer, and Mr. Theo. McMahan as diver and inspector, using a small hired sailboat and crew, and was completed on November 24. The actual under-water work was done in six days, four other days being lost on account of bad weather. The bow, sides, portion of her stern, etc., which were found standing, were shattered by 320 pounds of dynamite in 51 charges of from 5 to 11 pounds each, by which the upper portions of the wreck and cargo were removed, a part of the wreckage floating away, and the rest being

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scattered over the ocean bottom in deep water below the reach of vessels, or in such way that nothing was left projecting above the bottom.

A final inspection made on November 25 showed least depths of 33 feet of water over the area previously occupied by the wreck, which is 3 feet more depth than exists over the adjacent surrounding shoal. This wreck is therefore no longer an obstruction to the navigation of this locality.

No property of any value was recovered, nor was any attempt made to save any, since the cost of such work would have been greater than the value of the material saved (either through the direct expense of such work or the delay thereby caused to the main work of destruction of the wreck itself).

The total cost of this work was $667.18, including all expenses of first examination, subsequent and final inspection, and other superintendence in the field and office.

The unused funds have been returned to the United States Treasury, in accordance with the provisions of the special act and section above quoted.

9. WRECK OF SCHOONER O. D. WITHERELL.

The schooner *O. D. Witherell* was on October 25, 1894, reported to your office as then lying sunk in Nantucket Sound, southeast of the Bass River Light Station, and as therefore being a dangerous obstruction to the free navigation of the neighborhood. Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by approval of the Acting Secretary of War of October 29 and of the Chief of Engineers of October 30, 1894, the work of the removal of this wreck was authorized, and $1,000 was allotted for this purpose, work to be done by hired labor and the use of the Government plant.

According to the latest information, this vessel at the time when originally wrecked, on October 10, 1894, was loaded with coal; was on her way from one of the coal ports to Portland, Me., and during the severe storm of that date went ashore on the Kill Pond Bar, and sank in about 12 feet of water at a point about 2 miles east-southeast of the Bass River Light Station, and about 1 mile from the nearest shore, that of South Yarmouth. She was a two-decked, three-masted wooden schooner of 148 feet length, 33 feet breadth, 15 feet depth, 631 tons gross tonnage, built in 1874 at Bath, Me., documented from Dennis, Mass., and owned by Uriah B. Fisk.

While preparations were being made for the location and removal of this wreck, further report was received that the owners or other interested parties had unexpectedly succeeded in raising and floating her and towing her to her destination. This report was later verified by the field force while at work upon other wrecks in the neighborhood, so that this wreck is therefore no longer an obstruction to the navigation of this locality.

The total cost of this work (office work only) was $8.33.

The unused funds have been returned to the United States Treasury, in accordance with the provisions of the special act and section above quoted.

10. WRECK OF SCHOONER LIGHT (STAR) OF THE EAST.

The schooner *Star of the East* was on October 25, 1894, reported to your office as then lying sunk in Nantucket Sound, east-southeast of the Bass River Light Station, and as therefore being a dangerous obstruction to the free navigation of the neighborhood. Under the

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provisions of section 4 of the river and harbor act of June 14, 1880, and by approval of the Secretary of War of October 31, 1894, and of the Chief of Engineers of November 1, 1894, the work of the removal of this wreck was authorized, and $800 was allotted for this purpose, work to be done by hired labor and the use of the Government plant.

During the progress of work upon this wreck her name was found to be the *Light of the East* instead of the *Star of the East*, as originally reported.

According to the latest information, this vessel, the *Light of the East*, was originally wrecked on October 10, 1894; was at that time loaded with stone; was on her way from Franklin, Me., to Philadelphia, Pa.; and during the severe storm of that date struck on Kill Pond Bar, and sank in about 13 feet of water at a point about 2.5 miles east-southeast of the Bass River Light Station, and about 1.5 miles from the nearest shore, that of South Yarmouth. She was a one-decked, two-masted, wooden schooner of 92 feet length, 27 feet breadth, 8 feet depth, 147 tons gross tonnage, built in 1869 at Tremont, Me., documented from Ellsworth, Me., and owned by J. M. Higgins. Her owners or agents subsequently removed the cargo and stripped and abandoned her. Examinations of the wreck made on November 30, at the time of locating her exact position, and December 10 showed her masts gone; but her sides, bow, and portion of her stern standing, her bowsprit out of water about 3 feet, from 2 to 5 feet of water over her, and 13 feet of water around her. As the wreck still lay where she was liable to be struck by all vessels of up to 11 feet draft using this neighborhood, it was thought best that she be completely broken up and removed down to the level of the surrounding ocean bottom, to prevent her from endangering and obstructing navigation. The location of the wreck at that time is shown by sketches and maps now on file in this (Newport) office.

Field work upon this wreck was commenced on December 10 under Mr. E. Parrish as assistant engineer and Mr. Theodore McMahan as diver and inspector, using a small hired sailboat and crew, and was completed on December 19, 1894. The actual under-water work was done in four days, two other days being lost on account of bad weather. The hull, deck, bow, etc., which were found to be all there except a part of her stern, were shattered by 270 pounds of dynamite in 51 charges of from 5 to 11 pounds each, by which the entire wreck was broken up and removed, a part of the wreckage floating away, the rest being scattered over the ocean bottom below the reach of vessels, in such way that nothing was left projecting above the bottom.

During the high winds and heavy seas of December 18, and after she had been almost destroyed, she shifted her position to about 200 feet to the north and east of her former position, and into 18 feet of water, where her final destruction was completed on December 19.

A final inspection, made on December 19, showed least depths of 18 feet of water over the area last occupied and also of 13 feet over the area first occupied by the wreck, all of which is as much as exists over the adjacent ocean bottom or over the lines of approach thereto. This wreck is therefore no longer an obstruction to the navigation of this locality.

No property of any value was recovered, nor was any attempt made to save any, since the cost of such work would have been greater than the value of the material saved (either through the direct expense of such work or the delay thereby caused to the main work of destruction of the wreck itself).

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The total cost of this work was $439.22, including all expenses of first examination, subsequent and final inspection, and other superintendence in the field and office.

The unused funds have been returned to the United States Treasury in accordance with the provisions of the special act and section above quoted.

11. UNKNOWN WRECK IN NANTUCKET SOUND.

An unknown wreck was on October 26, 1894, reported to your office as then lying sunk in Nantucket Sound, about 3 miles north of the Great Point Light-House, and as therefore being a dangerous obstruction to the free navigation of the neighborhood. Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by approval of the Acting Secretary of War of October 31, 1894, and of the Chief of Engineers of November 1, 1894, the work of the removal of this wreck was authorized and $250 was allotted for this purpose, work to be done by hired labor and the use of the Government plant.

Nothing definite is known as to this wreck other than that its masts or spars projected above the water for several days on and after October 14, 1894, at a point about 3 miles north of the Great Point Light-House in about 7 fathoms depth of water. As the wreck, from its reported location, was found to be directly in the track of the majority of the vessels using this much-frequented highway, it was thought best that at least her masts and rigging should be removed down to 25 feet depth below low-water level, to prevent her from endangering and obstructing navigation.

Before the wreck could be definitely located and examined, it disappeared from sight. Since then no further reports have been received of any wreck in this locality. However, to make certain of its complete disappearance (important because of the large amount of travel at this place) the wrecking party on the 20th and 21st of December, 1894 (under Mr. George Eldridge as assistant engineer and Mr. Theodore McMahan as diver and inspector, using a small hired sailboat and crew), made a careful search for this wreck over an area of 2 square miles in the locality where it had been previously seen, but nothing of the kind was found. Personal inquiry was made of the keeper of the Great Point Light-House, but nothing further was learned thereby.

As this wreck was in deep water (about 42 feet) it is thought that its masts became detached in some way and either floated off or sank. It is therefore believed that this reported wreck is no longer an obstruction to the navigation of this locality.

The total cost of this work has therefore been only $87.70, including all expenses in the field and office.

The unused funds have been returned to the United States Treasury in accordance with the provisions of the special act and section above quoted.

12. WRECK OF SCHOONER MARIA ADELAIDE.

The schooner *Maria Adelaide* was on November 9, 1894, reported to your office as then lying sunk in the channel of the entrance to Cuttyhunk Pond, Massachusetts, and as therefore being a dangerous obstruction to the free navigation of the neighborhood. Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by approval of the Secretary of War and of the Chief of Engineers of November 15, 1894, the work of the removal of this wreck was author-

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ized and $125 was allotted for this purpose, work to be done by hired labor and the use of the Government plant.

No accurate information could be obtained as to the original occurrence of this wreck or as to her cargo, destination, etc., but it is currently reported that she was wrecked in September of 1890 on the Vineyard Sound side of Cuttyhunk Beach, where she is known to have lain, out of the way of vessels, up to October 10, 1894, when during the severe storm of that date the remnants of her hull were washed entirely across the beach (about 600 feet wide at this place) and lodged on the Buzzards Bay side, where she finally lodged in about 3 feet of water (at low tide) on the edge of the channel entrance to the pond (or interior harbor of Cuttyhunk) and about 50 feet from the nearest shore, that of the southern part of Cuttyhunk harbor. She was originally a wooden schooner of about 96 feet length, 24 feet breadth, 7 feet depth, 112 tons gross tonnage, built in 1872 at Brewer, Me., documented from Bangor, Me., and owned by George B. Cook. Examinations of the remaining portion of this wreck, made on November 10 and December 2, 1894, showed it to be composed of the starboard side, bottom, and keel, and to be about 70 feet long, 20 feet wide, and 5 feet deep, all of which was covered at high water and exposed at low water. As the wreckage, though lying in shallow water, still lay where it was liable to be struck by the light-draft vessels beating in and out of the pond, it was thought best that it be completely broken up and removed down to the level of the surrounding bottom, to prevent it from endangering and obstructing navigation. The location of this wreckage at that time is shown by sketches and maps now on file in this (Newport) office.

Field work upon this wreck was commenced on December 3, 1894, under Mr. E. Parrish as assistant engineer and Mr. Theodore McMahan as diver and inspector, using a small hired sailboat and crew, and was completed on December 6, 1894. This wreckage, as above described, was shattered by 175 pounds of dynamite in 59 charges of from 7 to 11 pounds each, by which all obstructing portions were broken up and removed, the smaller portions floating away or scattering over the harbor bottom, and the larger portions being hauled up on the beach above high water, all in such way that nothing was left projecting above the bottom.

A final inspection, made on December 6, showed a least depth of 3 feet of water at low tide over the area previously occupied by the wreckage, this being as much as exists over the adjacent bottom. This wreckage is therefore no longer an obstruction to the navigation of this locality.

No property of any value was recovered, nor was any attempt made to save any, since the cost of such work would have been greater than the value of the material saved (either through the direct expense of such work or the delay thereby caused to the main work of destruction of the wreckage itself).

The total cost of this work was $120.16, including all expenses of first examination, subsequent and final inspection, and other superintendence in the field and office.

The unused funds have been returned to the United States Treasury in accordance with the provisions of the special act and section above quoted.

13. WRECK OF SCHOONER S. S. SCRANTON.

The schooner *S. S. Scranton* was on November 17, 1894, reported to your office as then lying sunk in the entrance to Buzzards Bay, Massachusetts, about 1 mile southwest of Mishaum Point, and as therefore being

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a dangerous obstruction to the free navigation of the neighborhood. Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by approval of the Secretary of War and of the Chief of Engineers of November 20, 1894, the work of the removal of this wreck was authorized, and $350 was allotted for this purpose, work to be done by hired labor and the use of the Government plant.

According to the latest information, this vessel at the time when originally wrecked, on October 10, 1894, was loaded with bricks; was on her way from Fishers Island, Connecticut, to New Bedford, Mass., and sank in about 57 feet of water at a point about 1 mile southeast of Mishaum Point, and about 0.75 mile from the nearest shore, that of Barneys Joy Point. She was a one-decked, two-masted wooden schooner of 77 feet length, 22 feet breadth, 6 feet depth, 82 tons gross tonnage, built in 1869 at Middletown, Conn., and documented from Hartford, Conn. Examinations of the wreck, made on December 5, at the time her exact location was determined, showed her spars projecting about 6 feet at low water, while soundings showed from 44 to 46 feet of water over her decks, and from 55 to 57 feet around her. As the wreck, though lying in deep water, still lay where her masts and rigging were liable to be struck by the light-draft vessels going up the north shore of Buzzards Bay, it was thought best that her masts and rigging be removed down to at least 28 feet depth below low-water level, to prevent her from endangering and obstructing navigation. The location of the wreck at that time is shown by sketches and maps now on file in this (Newport) office.

Field work upon the removal of this wreck was commenced on December 27, 1894, under Mr. E. Parrish as assistant engineer, and Mr. Theodore McMahan as diver and inspector, using a small hired sailboat and crew, and was completed on January 1, 1895. The actual under-water work was done in two days, two other days being lost on account of bad weather. The wreck was found to be in practically the same condition as when located, and her masts were shattered by 24 pounds of dynamite in 4 charges, by which the foremast was completely removed and the mainmast cut off about 10 feet above the deck, a large part of the wreckage floating away, and the rest sinking in deep water below the reach of vessels.

A final inspection, made on January 1, showed a least depth of about 40 feet of water over the remaining portions of the wreck, and from 55 to 57 feet of water around her. This wreck is therefore no longer an obstruction to the navigation of this locality.

No property of any value was recovered, nor was any attempt made to save any, since the cost of such work would have been greater than the value of the material saved (either through the direct expense of such work or the delay thereby caused to the main work of destruction of the wreck itself).

The total cost of this work was $254.31, including all expenses of first examination, subsequent and final inspection, and other superintendence in the field and office.

The unused funds have been returned to the United States Treasury in accordance with the provisions of the special act and section above quoted.

14. WRECK OF SCHOONER E. K. HART.

The schooner *E. K. Hart* was on November 21, 1894, reported to your office as then lying sunk near the middle of Tarpaulin Cove Harbor, Naushon Island, Massachusetts, and as therefore being a dangerous

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obstruction to the free navigation of the neighborhood. Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by approval of the Secretary of War and of the Chief of Engineers of December 1, 1894, the work of the removal of this wreck was authorized, and $800 was allotted for this purpose, work to be done by hired labor and the use of the Government plant.

According to the latest information, this vessel at the time when originally wrecked, on October 10, 1894, was loaded with paving stone; was on her way from Boston, Mass., to Bridgeport, Conn., and sank in about 15 feet of water at a point about 100 yards southeast of the buoy inside the harbor and about 0.25 mile from the nearest shore. She was a one-decked, three-masted wooden schooner of 100 feet length, 20 feet breadth, 7 feet depth, 90 tons gross tonnage, built in 1874 at Toledo, Ohio, documented from Alexandria, Va., and owned by J. S. Kintz. Examinations of the wreck, made on December 22, showed her to be all intact with the exception of the spars and cargo (which had been removed by her owners) and with from 2 to 6 feet depth of water over her, and 15 feet depth of water around her. As the wreck still lay where she was liable to be struck by all craft using this harbor, it was thought best that her hull be completely removed down to the level of the surrounding harbor bottom to prevent her from endangering and obstructing navigation. The location of the wreck at that time is shown by sketches and maps now on file in this (Newport) office.

Field work upon this wreck was commenced on December 22, under Mr. E. Parrish as assistant engineer and Mr. Theodore McMahan as diver and inspector, using a small hired sailboat and crew, and was completed on January 1, 1895. The actual under-water work was done in five days, six other days being lost on account of bad weather and work on a more dangerous wreck in the neighborhood. The hull and deck, which were found to be composed of sound oak timber, were shattered by 588 pounds of dynamite in 97 charges of from 2 to 10 pounds each, by which the entire wreck was broken up and removed, a part of the wreckage floating away, and the rest being scattered in such way that nothing was left projecting above the bottom.

A final inspection, made on January 1, showed a least depth of 18 feet of water over the area previously occupied by the wreck, this being 3 feet more depth than exists over the adjacent parts of the harbor bottom. This wreck is therefore no longer an obstruction to the navigation of the locality.

No property of any value was recovered, nor was any attempt made to save any, since the cost of such work would have been greater than the value of the material saved (either through the direct expense of such work or the delay thereby caused to the main work of destruction of the wreck itself).

The total cost of this work was $321.38, including all expenses of first examination, subsequent and final inspection, and other superintendence in the field and office.

The unused funds have been returned to the United States Treasury in accordance with the provisions of the special act and section above quoted.

15. WRECK OF SCHOONER JULIA E. PRATT.

The schooner *Julia E. Pratt* was on December 13, 1894, reported to your office as then lying sunk in Nantucket Harbor, and as therefore being a dangerous obstruction to the free navigation of the neighborhood. Under the provisions of section 4 of the river and harbor act of

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June 14, 1880, and by approval of the Secretary of War and of the Chief of Engineers of December 17, 1894, the work of the removal of this wreck was authorized, and $200 was allotted for this purpose, work to be done by hired labor and the use of the Government plant.

According to the latest information, this vessel was originally wrecked about ten years ago on Great Point Rip, while loaded with lumber; was towed into Nantucket Harbor, where she broke up, one of the largest sections finally sinking in about 8 feet of water in the southeastern part of the harbor at a point about 500 feet from the nearest shore. She was a wooden schooner of 200 tons gross tonnage, and approximately 100 feet length, 25 feet breadth, and 8 feet depth; built in 1860 at Essex, Mass.; documented from Boston, Mass., and owned by J. T. Cumis. Examinations of the wreck, made on January 9, showed her remaining parts to be in the above location, to be about 70 feet long, from 8 to 10 feet wide, and to include a portion of her keel, centerboard casing, and a few ribs, with 4 feet depth of water over her and 8 feet depth of water around her. As the wreck has been for some time reported on the Coast Survey charts of this harbor as an obstruction to be avoided, and she still lay where she was liable to be struck by the small craft using this harbor, it was thought best that she should be removed down to the level of the surrounding harbor bottom, to prevent her from further endangering and obstructing navigation. The location of the wreck at that time is shown by sketches and maps now on file in this (Newport) office.

Field work upon the removal of this wreck was commenced on January 9, under Mr. E. Parrish as assistant engineer and Mr. Theodore McMahan as diver and inspector, using a small hired sailboat and crew, and was completed on January 10. The under-water work occupied parts of these two days. The wreck, which was found as above described, was shattered by 44 pounds of dynamite in 14 charges of from 2 to 6 pounds each, by which she was all broken up and removed, a part of the wreckage floating away and the rest being scattered over the harbor bottom in such way that nothing was left projecting above the bottom.

A final inspection made on January 10 showed a least depth of 8 feet of water over the area lately occupied by the wreck, this being as much as exists over the adjacent harbor bottom. This wreck is therefore no longer an obstruction to the navigation of this locality.

No property of any value was recovered, nor was any attempt made to save any, since the cost of such work would have been greater than the value of the material saved (either through the direct expense of such work or the delay thereby caused to the main work of the destruction of the wreck itself).

The total cost of this work was $127.04, including all expenses of first examination, subsequent and final inspection, and other superintendence in the field and office.

The unused funds have been returned to the United States Treasury in accordance with the provisions of the special act and section above quoted.

16. WRECK OF SCHOONER ELLEN MORRISON.

The schooner *Ellen Morrison* was on December 8, 1894, reported to your office as then lying sunk about one mile west northwest of the Monomoy Point Light House, and as therefore being a dangerous obstruction to the free navigation of the neighborhood. Under the provisions of section 4 of the river and harbor act of June 14, 1880, and

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by approval of the Secretary of War and of the Chief of Engineers of December 11, 1894, the work of the removal of this wreck was authorized, and $400 was allotted for this purpose, work to be done by hired labor and the use of the Government plant.

According to the latest information this vessel at the time when originally wrecked, on October 16, 1894, was loaded with lumber; was on her way from Bangor, Me., to New London, Conn., and during the severe storm of that date went ashore on Shovelful Shoal, but was driven off in another storm, drifted about for several days, and was then towed in near Monomoy Point, anchored, stripped of her cargo, etc., and abandoned. She finally broke up into several pieces, all of which were washed in near shore and lodged or sunk in from 4 to 6 feet of water at points in the vicinity of the entrance to the Powder Hole Harbor. She was a one-decked, two-masted wooden schooner of 100 feet length, 24 feet breadth, 9 feet depth, 171 tons gross tonnage, built in 1850 at New Haven, Conn., documented from Bangor, Me., and owned by W. A. Swett. Examinations of the wreck made on January 8 showed one large and two small pieces lying within an area of about one-half acre in extent. The largest piece was about 90 feet long, 20 feet wide, and composed of the keel, keelson, and port side, and lay in 4 feet of water; the intermediate piece was about 12 feet long, 10 feet wide, and composed of four ribs, and lay in 6 feet of water, while the small piece was composed of only one rib and lay in 4 feet of water. As these pieces of the wreck, though lying in shallow water, still lay where they were liable to be struck by the boatmen of the neighborhood while attempting to enter the harbor, it was thought best that they be completely destroyed and removed down to the level of the harbor bottom to prevent them from endangering and obstructing navigation. The location of the wreck at that time is shown by sketches and maps now on file in this (Newport) office.

Field work upon the removal of this wreck was commenced on January 2, under Mr. E. Parrish as assistant engineer and Mr. Theodore McMahan as diver and inspector, using a small hired sailboat and crew, and was completed on January 15. The actual under-water work was done in two days, five other days being lost on account of ice and bad weather. These pieces, which were found as above described, were shattered by 220 pounds of dynamite in 62 charges of from 2 to 6 pounds each, by which they were all broken up and removed, a large part of the wreckage floating away and the rest being hauled up on the beach above high water or scattered over the harbor bottom in such a way that nothing was left projecting above the bottom.

A final inspection made on January 15 over the area lately occupied by each piece showed that everything had been removed to the general level of the surrounding harbor bottom. This wreck is therefore no longer an obstruction to the navigation of this locality.

No property of any value was recovered, nor was any attempt made to save any, since the cost of such work would have been greater than the value of the material saved (either through the direct expense of such work or the delay thereby caused to the main work of destruction of the wreck itself).

The total cost of this work was $367.60, including all expense of first examination, subsequent and final inspection, and other superintendence in the field and office.

The unused funds have been returned to the United States Treasury in accordance with the provisions of the special act and section above quoted.

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17. WRECK NEAR WESTERN ENTRANCE TO VINEYARD SOUND.

An unknown wreck was on January 11, 1895, reported to your office as then lying sunk about 2 miles northwest of Browns Ledge and about 8 miles west of the western entrance of Vineyard Sound, and as therefore being a dangerous obstruction to the free navigation of the neighborhood. Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by approval of the Secretary of War and of the Chief of Engineers of January 14, 1895, the work of the removal of this wreck was authorized, and $200 was allotted for this purpose, work to be done by hired labor and the use of the Government plant.

Nothing definite was known at that time as to the name of this wreck, but according to quite recent information she is now believed to be the *Harry L. Whiton*, a wooden schooner of 134 feet length, 32 feet breadth, 15 feet depth, 481 tons gross tonnage, built in 1873 at Duxbury, Mass., documented from Boston, Mass., owned by J. M. Rich, and was wrecked during the forepart of 1894, being at that time loaded with plaster. One of her masts was seen several times in this locality during the forepart of January, and on January 4 she was definitely located by Commander Thomas Perry, commanding the U. S. S. *Castine*. Examinations of the wreck made on January 30, at the time of her location by this office, showed the wreck to be in about 96 feet of water at a point about 6.75 miles south by east from the Sakonnet Light-House, 8.25 miles SW. $\frac{7}{8}$ W. from the Hen and Chickens Light-Ship, and about 7 miles from the nearest shore, that of Sakonnet Point, one of her masts still standing about 5 feet out of the water at low tide. The vegetable growth and barnacles on the mast, the reports received from various steamboat captains, and other indications are all in favor of the supposition that this mast was attached to the rigging of a wreck still lying underneath it on the ocean bottom, and that such wreck had been there for several months, thus in a manner confirming the recent report. As the wreck, though in deep water, still lay where her mast was liable to be struck by all craft passing from Long Island Sound to Vineyard Sound, it was thought best that the projecting mast and rigging be removed down to at least 30 feet depth below low water, to prevent her from endangering and obstructing navigation. The location of the wreck at that time is shown by sketches and maps now on file in this (Newport) office.

Field work upon the removal of this wreck was commenced on January 25, under Mr. J. H. Rostock as assistant engineer and Mr. Theodore McMahan as diver and inspector, using a hired tugboat and crew, and was completed on January 30, 1895. The actual under-water work was done in one day, five other days being lost on account of bad weather. The mast of the wreck was shattered by 13 pounds of dynamite in 2 charges of 10 and 3 pounds respectively, by which the obstructing portions of the wreck were removed, a large part of the wreckage floating away and the rest sinking in deep water below the reach of vessels. The weather and sea at this time were too unfavorable to admit of any examination of what was below the mast.

A final inspection made on January 30 showed a least depth of about 40 feet of water over any possible remaining portions of the wreck. The wreck is therefore no longer an obstruction to the navigation of this locality.

No property of any value was recovered, nor was any attempt made to save any, since the cost of such work would have been greater than the value of the material saved (either through the direct expense of

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such work or the delay thereby caused to the main work of destruction of the wreck itself).

The total cost of this work was $174.06, including all expenses of first examination, subsequent and final inspection, and other superintendence in the field and office.

The unused funds have been returned to the United States Treasury in accordance with the provisions of the special act and section above quoted.

18. WRECK OF SCHOONER ROYAL ARCH.

The schooner *Royal Arch* was on December 4, 1894, reported to your office as then lying sunk on Pollock Rip and as therefore being a dangerous obstruction to the free navigation of the neighborhood. Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by approval of the Secretary of War of December 10, and of the Chief of Engineers of December 11, 1894, the work of the removal of this wreck was authorized, and $1,000 was allotted for this purpose, work to be done by hired labor and the use of the Government plant.

According to the latest information, this vessel, at the time when originally wrecked, on November 28, 1894, was loaded with coal, was on her way from Port Johnson, N. J., to Boston, Mass., and while at anchor during a severe gale swung upon what was then supposed to be a submerged wreck (afterwards found to be a newly developed shoal) and sunk in about 14 feet of water at a point about 4 miles northeast of the Monomoy Light Station and about 3 miles from the nearest shore, that of Monomoy Beach. She was a one-decked, three-masted, wooden schooner of 132 feet length, 23 feet breadth, 10 feet depth, 422 tons gross tonnage, built in 1873 at East Haven, Conn., documented from New Haven, Conn., and owned by W. H. Landers. Examinations of the wreck made on December 15, at the time of her location by this office, showed her to be all there excepting her masts and bowsprit; that she had evidently shifted her position to a point about 250 feet to the westward of where first wrecked, where she lay with her decks just awash and with 16 feet of water all around her. As the wreck still lay close to the channel and where she was liable to be struck by all light-draft vessels using this neighborhood, it was thought best that her hull be completely removed down to the level of the surrounding ocean bottom to prevent her from endangering and obstructing navigation. The location of the wreck at that time is shown by sketches and maps now on file in this (Newport) office.

Field work upon the removal of this wreck was commenced February 1 under Mr. E. Parrish as assistant engineer and Mr. Theodore McMahan as diver and inspector, using a small hired sailboat and crew, and was completed on March 20. The actual under-water work was done in two days, about forty other days being lost on account of bad weather and because the harbors of the neighborhood were blocked by ice. During this delay the heavy seas had considerably broken up the vessel and carried a good deal of it away. The portions of her bottom, side, and two of her booms which were found remaining were shattered by 26 pounds of dynamite in 6 charges of from 2 to 6 pounds each, by which she was all broken up and removed, a large part of the wreckage floating away and the rest being scattered over the ocean bottom below the reach of vessels in such way that nothing was left projecting above the bottom.

A final inspection, made on March 20, showed a least depth of 14 feet of water over the area last occupied by the wreck, this being as much

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as was found to exist over the adjacent ocean bottom. This wreck is therefore no longer an obstruction to the navigation of this locality.

No property of any value was recovered, nor was any attempt made to save any, since the cost of such work would have been greater than the value of the material saved (either through the direct expense of such work or the delay thereby caused to the main work of destruction of the wreck itself).

The total cost of the work was $671.60, including all expenses of first examination, subsequent and final inspection, and other superintendence in the field and office.

The unused funds have been returned to the United States Treasury, in accordance with the provisions of the special act and section above quoted.

19. WRECK IN POLLOCK RIP.

An unknown submerged wreck was on December 4, 1894, reported to your office as then lying sunk on Pollock Rip, as having already been struck by one vessel, the *Royal Arch*, and as therefore being a dangerous obstruction to the free navigation of the neighborhood. Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by approval of the Secretary of War of December 10, and of the Chief of Engineers of December 11, 1894, the work of the removal of this wreck was authorized, and $1,000 was allotted for this purpose, work to be done by hired labor and the use of the Government plant.

The above report was based upon the statements of the captain of the *Royal Arch*, who was positive that his vessel was in deep water at that time and could not have been touched by anything but a submerged wreck. His statements were apparently substantiated by the Coast Survey charts. But later reports and examinations showed the existence of a newly developed shoal at this place, and it was then evident that the unknown submerged wreck was an imaginary one. This condition of affairs was fully verified during the progress of the removal of the *Royal Arch*, when a thorough examination was made over an area of 400 square feet around the place where the wreck was first reported to be, but without finding any signs of such a wreck.

The new shoal was reported to the Coast Survey Office, and will be shown on its future maps.

As the field work of examination for this wreck was covered by that upon the *Royal Arch* (otherwise provided for) and as the office work was consequently almost nothing, none of the allotted funds were expended in behalf of this supposed wreck.

The unused money—that is, the entire allotment—has been returned to the United States Treasury, in accordance with the provisions of the special act and section above quoted.

20. WRECK ON BEARSES SHOAL.

An unknown wreck was on January 23, 1895, reported to your office as then lying sunk on Bearses Shoal, near Pollock Rip, and as therefore being a dangerous obstruction to the free navigation of the neighborhood. Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by approval of the Secretary of War of January 29, and of the Chief of Engineers of January 30, the work of the removal of this wreck was authorized, and $600 was allotted for this purpose, work to be done by hired labor and the use of the Government plant.

Nothing definite is known as to the name of this wreck or as to where or when she was wrecked other than that she was first seen drifting

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toward Pollock Rip Shoal, where she finally grounded in about 16 feet of water at a point about 2.5 miles northeast of the Monomoy Light Station, about 1 mile southwest of where the *Royal Arch* was wrecked and about 2¼ miles from the nearest shore, that of Monomoy Beach. Examinations of the wreck made on February 23, at the time of her location by this office, showed her to apparently consist of the bowsprit and some other portions of the bow of a large vessel lying in 18 feet of water. As the wreck still lay close to the channel north of Bearses Shoal, where she was liable to be struck by the light-draft vessels using this neighborhood, it was thought best that she be completely destroyed to prevent her from endangering and obstructing navigation. The location of the wreck at that time is shown by sketches and maps now on file in this (Newport) office.

Field work upon the removal of this wreck was commenced on February 21 under Mr. E. Parrish as assistant engineer and Mr. Theodore McMahan as diver and inspector, using a small hired sailboat and crew, and was completed on March 20. The actual under-water work was done in two days, about twenty other days being lost on account of the ice and unfavorable weather. The stem and bowsprit (anchored by the bobstays and some rigging), which were found remaining, were shattered by 16 pounds of dynamite in 2 charges of 8 pounds each, by which the obstruction was completely broken up and removed, a part of the wreckage floating away and the rest being scattered over the ocean bottom below the reach of vessels in such way that nothing was left projecting above the bottom.

A final inspection, made on March 20, showed a least depth of 18 feet of water over the area lately occupied by the wreck, which is as much as exists over the adjacent ocean bottom. This wreck is therefore no longer an obstruction to the navigation of this locality.

No property of any value was recovered, nor was any attempt made to save any, since the cost of such work would have been greater than the value of the material saved (either through the direct expense of such work or the delay thereby caused to the main work of destruction of the wreck itself).

The total cost of this work was $388.88, including all expenses of first examination, subsequent and final inspection, and other superintendence in the field and office.

The unused funds have been returned to the United States Treasury, in accordance with the provisions of the special act and section above quoted.

21. UNKNOWN WRECK NEAR GARDINERS ISLAND, LONG ISLAND SOUND.

An unknown wreck was reported in February, 1895, as then lying sunk near the north end of Gardiners Island, in Long Island Sound, and as being a dangerous obstruction to the free navigation of the neighborhood. Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by indorsement of the Secretary of War and letter of the Chief of Engineers of March 1, 1895, the work of the removal of this wreck was authorized, and $250 was allotted for this purpose, work to be done by hired labor and the use of the Government plant, as soon as practicable after the expiration of the time limit imposed by law.

No definite information has come to the knowledge of this office as to the name of this wreck, or where or when she was wrecked, other than

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that she was first seen about the middle of February of this year exposing two of her masts (heel up) which were apparently attached by the rigging to something else under the surface, in about 108 feet of water at a point about 7.75 miles east of Gardiners Point, about 1 mile west of Cerbeus Shoal, and about 5 miles from the nearest shore, that of Fishers Island. As the wreck, from its reported location, was found to lie where she was liable to be struck by some of the many passing vessels, it was thought best that her masts and rigging be cut off to a depth of at least 30 feet below low-water level, to prevent her from endangering and obstructing navigation.

On March 16 an unsuccessful effort was made by Assistant Engineer E. Parrish to find and locate this wreck, using only a small sailboat therefor. On April 6 and 7, a second and more thorough search was made under more favorable circumstances, under Assistant Engineer J. H. Rostock, using the wrecking schooner and crew therefor, but all efforts were again unsuccessful; and it was believed at the time, and is now, that she either sank or was removed in some way by the strong tide or currents. Personal inquiry was also made of the fishermen and the master of the light-house tender *Cactus* (who first reported the wreck), but nothing further was learned as to her existence subsequently to the day of her first report.

No final inspection of the condition of this wreck could be made by this office, owing to the total disappearance of such wreck and to the absence of any accurate observations as to its exact location. Final report has, however, been purposely delayed in order that the continued absence of further complaints as to the existence of such an obstruction at that locality should confirm its reported disappearance. Up to this date, May 31, 1895, no such complaints have been heard of by this office. It is therefore believed to be no longer an obstruction to the navigation of this locality.

The total cost of this work was $206.30, including all expenses of first and second examinations, and other superintendence in the field and office.

The unused funds will be returned to the United States Treasury in accordance with the provisions of the special act and section above quoted.

22. UNKNOWN WRECK IN VINEYARD SOUND NEAR THE VINEYARD SOUND LIGHT-SHIP.

An unknown wreck was on March 4, 1895, reported to your office as then lying sunk in Vineyard Sound, between the Vineyard Sound Light-Ship and the Sow and Pigs Reef Buoy, and as therefore being a dangerous obstruction to the free navigation of the neighborhood. Under the provisions of section 4 of the river and harbor act of June 14, 1880, the removal of this wreck was approved by the Secretary of War and the work of removal authorized by the Chief of Engineers, under date of March 6, 1895, $300 having been allotted for this purpose; work to be done by hired labor and the use of the Government plant.

No authentic information has come to the knowledge of this office as to where or when this vessel was wrecked, other than that she was first seen about the middle of February of this year in about 60 feet of water at a point about 1.25 miles northeast of the Vineyard Sound Light-Ship, and about 2.25 miles from the nearest shore, that of the southwest bluff of Cuttyhunk, and exposing about 6 or 8 feet of one of her masts and some other wreckage, all apparently attached to something on the

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bottom. Current rumor combined with the reports of the diver of the wrecking party are in favor of her being the *T. P. Dixon*, a wooden schooner of 75 feet length; 26 feet breadth; 8 feet depth; 130 tons gross tonnage; built in 1887 at City Island, N. Y.; documented from New York, N. Y.; and owned by S. L. Keen. Examinations of the wreck, made on April 5 (the date of her location by this office) and also on April 17, showed that the heavy seas had by that time left very little of the original vessel remaining, there being only one spar (which still projected about 8 feet out of the water at high tide), bowsprit, and a small piece of her side, these portions having from 12 to 15 feet of water over them, and all lying in about 60 feet of water and anchored to the bottom by her rigging. As the wreck still lay where she was liable to be struck by any of the craft using this neighborhood, it was thought best that what was left of her should be completely destroyed to prevent her from endangering and obstructing navigation. The location of the wreck at that time is shown by sketches and maps now on file in this (Newport) office.

Field work upon the removal of this wreck was commenced on April 17 under Mr. E. Parrish, as assistant engineer, and Mr. Theodore McMahan, as diver and inspector, using a small hired sailboat and crew, and was completed on the same day. The spar, bowsprit, etc., as above described, were shatterd by 7 pounds of dynamite in 2 charges of 3 and 4 pounds each, by which the entire wreck was broken up and removed, a part of the wreckage floating away, and the rest sinking in deep water below the reach of vessels.

A final inspection made on April 17 showed a least depth of 60 feet of water over the area last occupied by the wreck. This wreck is therefore no longer an obstruction to the navigation of this locality.

No property of any value was recovered; nor was any attempt made to save any, since the cost of such work would have been greater than the value of the material saved (either through the direct expense of such work or the delay thereby caused to the main work of destruction of the wreck itself).

The total cost of this work was $156.80, including all expenses of first examination, subsequent and final inspection, and other superintendence in the field and office.

The unused funds will be returned to the United States Treasury in accordance with the provisions of the special act and section above quoted.

23. BARGE OFF POINT JUDITH.

An unknown wreck was on March 16, 1895, reported to your office as then lying sunk a short distance southeast of Point Judith, and as therefore being a dangerous obstruction to the free navigation of the neighborhood. Under the provisions of section 4 of the river and harbor act of June 14, 1880, the removal of this wreck was approved by the Secretary of War, and the work of removal authorized by the Chief of Engineers under date of March 21, $1,000 having been allotted for this purpose, work to be done by hired labor and the use of the Government plant.

Nothing definite is known as to the name or original dimensions of this wreck, except that she was supposed to be what was left of one of five coal-laden barges known to have been wrecked near this point by the severe storm of January 25, while on their way from Perth Amboy, N. J., to Providence, R. I. She lay in about 48 feet of water at a point about three-quarters of a mile from Point Judith, the nearest

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shore. Examinations of the wreck, made on March 23 (the date of her location by this office) and April 1, showed her to be composed of merely the bow (which projected a few feet above water) and about 75 feet length and 30 feet width of the port side of the barge, the whole being held in an inclined position under the water by one of her anchors. Neither the other parts of this barge nor the other four barges (forming originally the same tow) were to be found; so that the obstruction was much smaller than supposed when first reported. However, as the wreck still lay where she was liable to be struck by any of the many steamers and vessels of all kinds constantly passing this point, it was thought best that she be completely destroyed, to prevent her from endangering and obstructing navigation. The location of the wreck at that time is shown by sketches and maps now on file in this (Newport) office. Her early removal was urgently demanded by the boat owners of this neighborhood.

Field work upon the removal of this wreck was commenced (after one week's delay on account of bad weather) on April 1, under Mr. E. Parrish, as assistant engineer, and Theodore McMahan, as diver and inspector, using the Government naphtha launch and a small hired sailboat and crew, and was completed on the same day. The bow and side, as above described, were shattered by 25 pounds of dynamite in 5 charges of about 5 pounds each, by which the entire wreck was broken up and removed, a large part of the wreckage floating away, and the rest sinking in deep water below the reach of vessels.

A final inspection, made on April 1, showed a least depth of 48 feet of water over the area last occupied by the wreck. This wreck is therefore no longer an obstruction to the navigation of this locality.

No property of any value was recovered, nor was any attempt made to save any, since the cost of such work would have been greater than the value of the material saved (either through the direct expense of such work or the delay thereby caused to the main work of destruction of the wreck itself).

The total cost of this work was $324.20, including all expenses of first examination, subsequent and final inspection, and other superintendence in the field and office.

The unused funds will be returned to the United States Treasury in accordance with the provisions of the special act and section above quoted.

24. WRECK IN CHATHAM ROADS, MASSACHUSETTS.

An unknown wreck was on April 13, 1895, reported to your office as then lying sunk off the northern part of Common Flats, in Chatham Roads, Nantucket Sound, Massachusetts, and as therefore being a dangerous obstruction to the free navigation of the neighborhood. Under the provisions of section 4 of the river and harbor act of June 14, 1880, the removal of this wreck was approved by the Secretary of War, and the work of removal authorized by the Chief of Engineers under date of April 16, 1895, $350 being allotted for this purpose, work to be done by hired labor and the use of the Government plant.

No definite information could be obtained as to the identity or original occurrence of this wreck, other than she had been seen in this locality in February of this year, drifted to her late position during the forepart of April, and grounded in about 20 feet of water at a point about one-third of a mile distant from the nearest shore, that of Hardings Beach. She is supposed to have been cut down and sunk by the heavy drifting ice of last winter. Examinations of the wreck, made

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on April 19 (the date of her location by this office) and April 22 showed her to be of about 22 feet length, 5 feet width, and apparently composed of part of the starboard side of a comparatively new vessel of probably 30 tons register. One end of the wreck was deeply embedded in the sand, the other end just covered at high tide. Her wreck was complained of by boatmen of the neighborhood as specially dangerous to navigation because of her location and her nearness to the surface of the water. As the wreck still lay where she was liable to be struck by all vessels bound in and out of Stage Harbor, it was thought best that she be completely removed, to prevent her from endangering and obstructing navigation. The location of the wreck at that time is shown by sketches and maps now on file in this (Newport) office.

Field work upon the removal of this wreck was commenced on April 22 under Mr. E. Parrish, as assistant engineer, and Mr. Theodore McMahan, as diver and inspector, using a small hired sailboat and crew, and was completed on the same day. The wreck, as above described, was shattered by 11 pounds of dynamite in 3 charges of from 3 to 5 pounds each, by which the entire wreck was broken up and removed, a part of the wreckage floating away, and the rest being scattered over the ocean bottom below the reach of vessels, or in such way that nothing was left projecting above the bottom.

A final inspection, made on April 22, showed a least depth of 20 feet of water over the area lately occupied by the wreck, this being as much as exists over the adjacent sound bottom. This wreck is therefore no longer an obstruction to the navigation of this locality.

No property of any value was recovered, nor was any attempt made to save any, since the cost of such work would have been greater than the value of the material saved (either through the direct expense of such work or the delay thereby caused to the main work of destruction of the wreck itself).

The total cost of this work was $140.07, including all expenses of first examination, subsequent and final inspection, and other superintendence in the field and office.

The unused funds will be returned to the United States Treasury in accordance with the provisions of the special act and section above quoted.

25. WRECK OF SCHOONER JOSIAH R. SMITH.

The schooner *Josiah R. Smith* was on April 18, 1895, reported to your office as then lying sunk in Vineyard Sound, and as therefore being a dangerous obstruction to the free navigation of the neighborhood. Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by authority of the Secretary of War and of the Chief of Engineers of April 22, the work of the removal of this wreck was authorized, and $350 was allotted for this purpose, work to be done by hired labor and the use of the Government plant, as soon as practicable after the expiration of the time limit imposed by law.

According to the latest information this vessel, at the time when originally wrecked, on April 7, 1895, was loaded with coal; was on her way from Baltimore, Md., to Boston, Mass.; collided with the barge *Lone Star*, and sank in about 90 feet of water at a point about 3.75 miles southeast of the Cuttyhunk Life-Saving Station, and about 2 miles from the nearest shore, that of Gay Head. She was a three-masted schooner of 166 feet length, 35 feet breadth, 15 feet depth, 704 tons gross tonnage, built in 1883 at Bath, Me., documented from Bath, Me., and owned by William T. Donnell. Examinations of the wreck,

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made on May 29 (at the time of her location by this office) and June 10, showed her three masts still standing about 30 feet above water, while one boom and two gaffs were just awash at low water. As the wreck, though lying in deep water, still lay where she was liable to be struck by any of the many passing craft, it was thought best that her masts, rigging, etc., be removed to at least 30 feet depth below low-water level, to prevent her from endangering and obstructing navigation. The location of the wreck at that time is shown by sketches and maps now on file in this (Newport) office.

Field work upon the removal of this wreck was commenced on June 10 under Mr. E. Parrish as assistant engineer, and Mr. Theodore McMahan as diver and inspector, using a small hired sailboat and crew, and was completed on June 11. The masts, boom, and gaffs, which were found as above described, were shattered by 200 pounds of dynamite in 33 charges of from 1 to 12 pounds each, by which the upper portions of the wreck were removed; a part of the wreckage floating away, and the rest sinking in deep water below the reach of vessels.

A final inspection made on April 11 showed least depth of from 61 to 75 feet of water over the remaining portions of the wreck and 90 feet all around her. This wreck is therefore no longer an obstruction to the navigation of this locality.

No property of any value was recovered, nor was any attempt made to save any, since the cost of such work would have been greater than the value of the material saved (either through the direct expense of such work, or the delay thereby caused to the main work of destruction of the wreck itself).

The total cost of this work was $270.60, including all expenses of first examination, subsequent and final inspection, and other superintendence in the field and office.

The unused funds will be returned to the United States Treasury at an early date, in accordance with the provisions of the special act and section above quoted.

26. WRECK OF BARGE ONEONTA.

The barge *Oneonta* was on April 19, 1895, reported as then lying sunk in Pollock Rip, and as therefore being a dangerous obstruction to the free navigation of the neighborhood. Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by the authority of the Secretary of War and of the Chief of Engineers of April 26, 1895, the work of the removal of this wreck was authorized, and $1,000 was allotted for this purpose; work to be commenced as soon as practicable after the expiration of the time limit imposed by law, and to be done by hired labor and the use of the Government plant.

According to the latest information this vessel, at the time when originally wrecked, April 10, 1895, was loaded with coal; and having collided with the schooner *Isaac H. Tillyer*, sank in 25 feet of water at low tide at a point about 1.75 miles west by south of the Pollock Rip Light-ship, and about 2.5 miles from the nearest shore, that of Monomoy Beach, Massachusetts. She was a one-decked, two-masted wooden barge of 180 feet length, 30 feet breadth, 15 feet depth, 586 tons gross tonnage, built in 1889 at Noank, Conn., documented from New York, N. Y., and owned by the Delaware and Hudson Canal Company. The wreck was examined and located May 11, 1895, by direction of this office. The wreck lay where, by her position, she was liable to be struck

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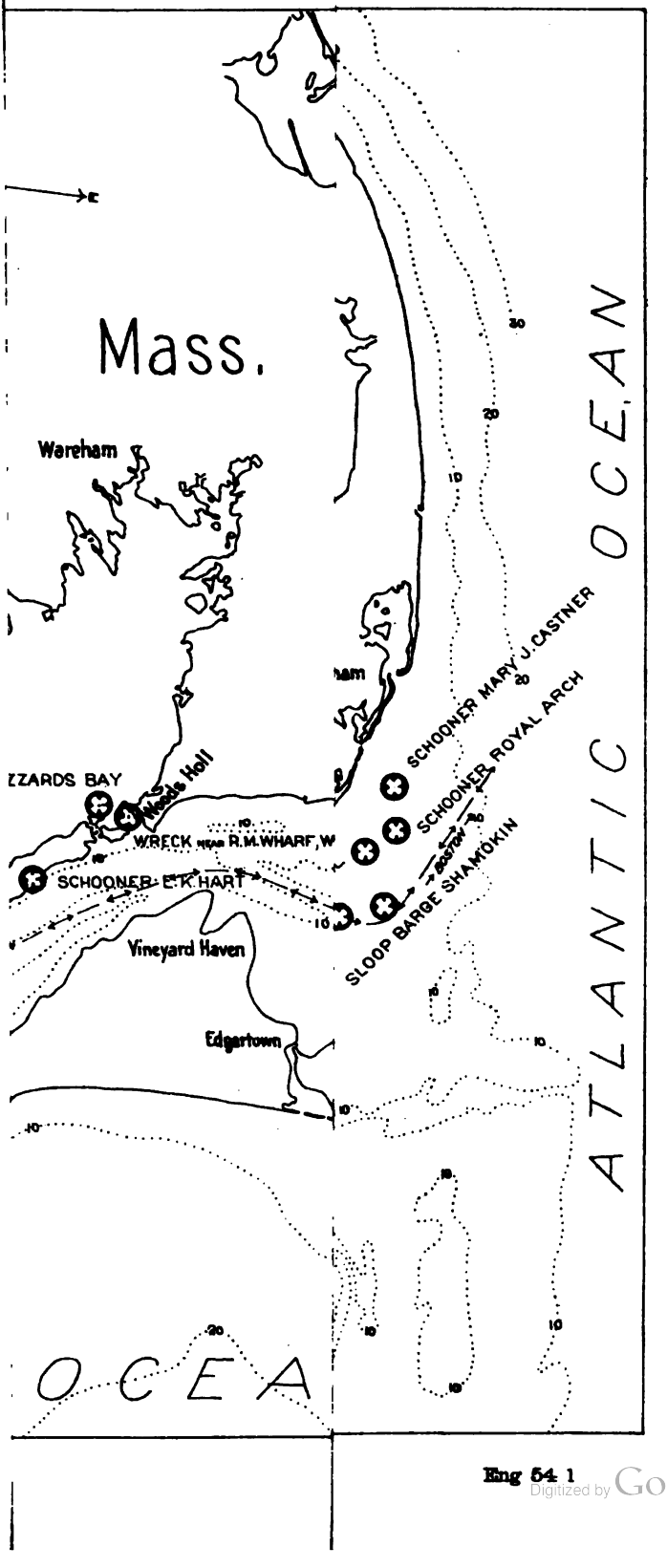

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by the various passing craft using this neighborhood, and so it was thought best that she be removed down to the level of the surrounding ocean bottom to prevent her from endangering other vessels.

Field work upon the removal of this wreck was commenced on June 15 under Mr. E. Parrish as assistant engineer, and Mr. Theo. McMahan as diver and inspector, using a small hired sailboat and crew. Work was still in progress at the end of the year, 995 pounds of dynamite in 117 charges having been expended, by which the greater portions of the wreck and cargo have been broken up and removed.

C 20.

PRELIMINARY EXAMINATION OF MOUNT HOPE BAY AND HARBOR OF FALL RIVER, MASSACHUSETTS.

[Printed in House Ex. Doc. No. 345, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., February 26, 1895.

SIR: I have the honor to submit the accompanying copy of report, dated the 21st instant, by Capt. W. H. Bixby, Corps of Engineers, of the results of a preliminary examination of Mount Hope Bay and harbor of Fall River, Mass., made to comply with the provisions of the river and harbor act of August 17, 1894.

It is the opinion of Captain Bixby, concurred in by Col. H. L. Abbot, Corps of Engineers, division engineer, and by this office, that this locality is worthy of improvement by the General Government.

The cost of a survey necessary for the preparation of plan and estimate of cost of improvement is estimated to be $3,000.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF CAPT. W. H. BIXBY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., February 21, 1895.

GENERAL: In accordance with the river and harbor act of August 17, 1894, and orders from your office dated August 20, 1894, I have the honor to submit a report, as follows, upon a preliminary examination of Mount Hope Bay and harbor of Fall River, Mass.

My opinions, as below stated, are based upon my own personal knowledge and careful study of this special locality, which has been visited by me in person several times during past years.

Mount Hope Bay (see Coast Survey chart No. 113) is the particular arm of Narragansett Bay which lies at the mouth of Taunton River. Fall River Harbor is at the upper end of Mount Hope Bay, and is the harbor of the city of Fall River.

The Taunton River has been under improvement by the General Government since 1870, and now allows vessels of 11 feet draft to at high

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water reach the city of Taunton, 14 miles above Fall River; and this river carries now an annual commerce of about 350,000 tons, or $4,600,000. All of this commerce must necessarily pass through Mount Hope Bay.

Fall River Harbor itself has also in the past, from 1874 to 1878, been under improvement by the General Government, by which it was provided with a channel of about 300 feet width and 12 feet depth at low water along the front of the city wharves. The anchorage ground in the river in front of the city carries about 25 feet depth at low water over a width of 1,000 feet and a length of 4 miles. In 1870 the city of Fall River had a population of only about 27,000; to-day it is the largest cotton manufacturing city in the United States, with a population of about 90,000, which is still rapidly increasing. Besides being a manufacturing town, Fall River is also a port of entry for foreign commerce and also the terminus of steamboat lines to New York and Philadelphia, and of railroad lines to Providence, Boston, and southern Massachusetts. As a consequence it carries a large commerce, which is each year increasing in value and tonnage, and is each year demanding accommodations for larger draft vessels. This commerce is roughly estimated at present at 3,000,000 tons, or $133,000,000, all of which must pass through Mount Hope Bay on its way to and from the ocean. The main items of this commerce are as follows:

Class of goods.	Exports.	Imports.	Total.	Tonnage.
Cotton and products	.....	$6,000,000	$6,000,000	30,000
Lumber and products	.....	600,000	600,000	30,000
Coal and minerals	.....	3,600,000	3,600,000	90,000
General merchandise	$60,000,000	62,000,000	122,000,000	1,220,000
Passengers (fares)	550,000	550,000	1,100,000	30,000
Total	60,550,000	72,750,000	133,300,000	1,400,000

The vessels entering and leaving this waterway (each entrance and departure together being counted as one) are as follows:

Character or class of service.	Number.	Average draft.	Average tonnage.
Steam:		*Feet.*	*Tons.*
Freight and passenger	1,900	12	2,000
Pleasure boats	800	3	7
Barges: Coal tows	175	13	900
Sail:			
Freight	700	16	850
Pleasure boats, large	600	5	.....
Pleasure boats, small	5,000	2	.....

Mount Hope Bay itself, forming the lower harborage of Fall River, is an exceedingly well landlocked anchorage ground of over 8 square miles area, all of which carries at least 14 feet depth and one-third of which carries over 25 feet depth at low water. For a short distance of about a mile in the middle part of this bay the channel depth diminishes to about 15 feet at low water, but elsewhere it is at least 25 feet deep for at least a quarter of a mile width. From the mouth of this bay to the ocean the channel depths are everywhere greater than 25 feet at low water.

To-day it appears desirable that the upper harbor of Fall River City and the short shoal portion of the middle Mount Hope Bay Channel should be deepened sufficiently to allow vessels that can at present

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enter the lower portions of Mount Hope Bay to proceed farther to the deep-water anchorage ground and to the upper harbor of the city of Fall River. This means a moderate amount of dredging to 25 feet depth at both places.

The steady growth of the cities of Fall River and Taunton and of their combined commerce during recent years, and the fact that such commerce is mainly one with neighboring States (and therefore not merely a local one) seem to me excellent reasons for further improvement of this locality by the General Government.

I have therefore to state my opinion that, for the reasons above given, Mount Hope Bay and the harbor of Fall River, Mass., are worthy of improvement by the General Government.

A survey of the same, with the view of submitting plans and estimate of cost for such improvement, is estimated to cost $3,000.

Very respectfully, your obedient servant,

W. H. BIXBY,
Captain, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

(Through Col. H. L. Abbot, Corps of Engineers, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, February 23, 1895.

Respectfully forwarded to the Chief of Engineers, United States Army.

For the reasons stated, I concur with Captain Bixby in considering Mount Hope Bay and Fall River Harbor as worthy of improvement by the General Government.

HENRY L. ABBOT,
Colonel of Engineers, Bvt. Brig. Gen., U. S. A.,
Division Engineer.

C 21.

PRELIMINARY EXAMINATION OF STONE BRIDGE OVER SAKONNET RIVER, RHODE ISLAND, TO ASCERTAIN THE COST OF WIDENING AND DEEPENING THE PASSAGE AT THE DRAW OF SAID BRIDGE.

[Printed in House Ex. Doc. No. 239, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., January 19, 1895.

SIR: The river and harbor act of August 17, 1894, makes provision for a preliminary examination of stone bridge over Sakonnet River, Rhode Island, "to ascertain the cost of widening and deepening the passage at the draw of said bridge to the same extent as prescribed in the recent order of the Secretary of War respecting the railroad bridge across said river, and the Secretary of War is directed to prepare and submit to Congress an estimate of the cost of such work."

The examination, directed to be made as above indicated, was assigned to the charge of Capt. W. H. Bixby, Corps of Engineers, under date of August 20, 1894, and I now have the honor to submit the accompanying copy of that officer's report of January 15, 1895, on the subject.

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Captain Bixby reports that in the order of the Secretary of War of July 1, 1893, directing the Old Colony Railroad Company to open its drawbridge to 100 feet width, no particular depth was specified, but that the request of the petitioners and the past recommendations of the local United States engineer officer agree upon a clear depth of 25 feet as necessary to present and future navigation; and that, for the reasons given, it is his opinion that the stone bridge over the Sakonnet River, so far as concerns the enlargement of its draw opening to 100 feet clear width and 25 feet clear depth at low water, is worthy of improvement by the General Government.

The opinion expressed by Captain Bixby is concurred in by Col. H. L. Abbot, Corps of Engineers, the division engineer, and by this office.

The cost of the work above indicated is estimated at $40,000.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF CAPT. W. H. BIXBY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., January 15, 1895.

GENERAL: I have the honor to report herewith upon the examination of the "stone bridge over the Sakonnet River, Rhode Island, to ascertain the cost of widening and deepening the passage at the draw of said bridge to the same extent as prescribed in the recent order of the Secretary of War respecting the railroad bridge across said river," as provided for by the river and harbor act of August 17, 1894, and as ordered by your letter of August 20, 1894.

HISTORY OF THE RIVER AND STONE BRIDGE.

The Sakonnet River is an arm of the sea between the island of Rhode Island and the mainland, in the vicinity of the towns of Little Compton and Tiverton, extending from the ocean to Narragansett Bay around the head of the island of Rhode Island, and making naturally a deep and specially safe water communication around that island from the ocean to Narragansett Bay and the inland cities of Providence, Fall River, Taunton, and the intermediate towns of the States of Rhode Island and Massachusetts. It is practically an eastern arm of Narragansett Bay. The entrance from the ocean is unobstructed, and a clear, broad, and nearly straight channel, running nearly north and south, and of at least 800 feet width and 23 feet depth, extends throughout its entire length, the river itself for a distance of about 11 miles at its lower (southern) end having a width of about 1.25 miles and a depth of up to 55 feet, and for a distance of about 1.5 miles at its upper end having a width of about one-sixth of a mile and a depth of up to 60 feet; thus offering naturally a direct and deep outlet to the ocean for the waters of Taunton River and the northeastern portion of Narragansett Bay. The only obstructions to its free navigation are the State highway bridge and the Old Colony Railroad Bridge, both at its upper (northern) end, near Tiverton.

The State bridge was originally private property, built by a corporation in 1794, under authority of the general assembly of the State of

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Rhode Island, and was operated as a toll bridge until 1869, when, being seriously damaged by wave action during a heavy storm, it was by its then owners (the Howland's Ferry Bridge Company) conveyed to the State of Rhode Island, whose property it has since been. The repairs of 1870–71 were made by the State; the subsequent maintenance and repair were by the State statutes imposed upon the adjacent towns of Little Compton, Tiverton, Portsmouth, Middletown, and Newport, while the jurisdiction of the adjacent waters was reserved to the State itself. (Secs. 19, 20, chap. 100, pp. 271, 272, Rhode Island statutes of 1882.)

The bridge is really a stone embankment or causeway extending completely across and damming the Sakonnet River, with the exception of one opening of about 29 feet width and a few inches depth of water at low tide, covered by a short section of permanent wooden bridge, and a second opening of about 35 feet clear width and about 9 feet depth of water at low tide, covered by a rolling drawbridge. The river channel just above and below the bridge has about a quarter of a mile width with 18 feet depth, and has about a sixth of a mile width with from 30 feet to 50 feet depth. (See Report of Rhode Island State commissioners of 1892, above quoted, and United States Coast Survey chart, No. 353.)

EXTENT OF RIVER TRAVEL.

Present travel.—Of course the present travel is not as great as it would be if there were no obstructions. One regular steamer and occasional excursion steamers run during the summer from Providence and other parts of Narragansett Bay through the bridge to the mouth of the Sakonnet River, and this travel is stated at over 17,000 passengers in a single season.

Schooners and sailboats use this route a little, but as little as possible at present on account of its difficulties, delays, and danger.

The combined travel is still enough to be very evident; and enough so that one insurance company alone claims to carry $200,000 insurance on vessels and cargoes passing through the bridges.

Probable future travel.—As stated above under the heading of "History of bridge," the Sakonnet River was and is naturally one of the outlets of Narragansett Bay, and is naturally by far the easiest and shortest route for vessels going from the Taunton River and Upper Narragansett Bay to Nantucket Sound and the East. The saving in distance (measured on Coast Survey charts) is at least 3 miles in case of vessels coming from or going to Providence, 4 miles in case of Warren, 6 miles in case of Bristol, and 12 miles in case of Coles River, Fall River, Somerset, Dighton, and Taunton, and 14 miles in case of Tiverton; all of these places being important shipping points. The Taunton River alone has a commerce of at least 400,000 tons or $6,000,000 per annum (see p. 616, Annual Report Chief of Engineers for 1892). Fall River also has a very large commerce by schooners as well as by steamer. At Tiverton is the very large fishing station of the Church Bros., so large as to use elevators capable of loading 1,000 barrels of fish per hour; that use eight fishing steamers of 60 to 160 feet length, from 8 to 15 feet draft, and from 16 to 45 feet width over all, and a large part of whose work is done eastward of the Sakonnet River. The possible loss per season to them alone is shown by the computation that 50 round trips for each of 8 steamers at 14 miles extra route each way makes nearly 12,000 extra miles, costing from, say, $2,000 to $12,000, according to circumstances. They claim for themselves during 1888, 1889, and 1890 an extra distance thus traveled

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by their steamers of 20,000 miles, and their total annual loss by extra travel and by time taken from actual work on the fishing ground as $30,000.

Over 60 boat captains and pilots have already made individual statements (see references below under head of "Petitions") that they are forced about 14 miles out of their route every trip to this vicinity.

The Fall River Yacht Club (through Mr. Burdick) and the Rhode Island Yacht Club (through Mr. Janes), representing 125 yachts, and some of from 9 to 12 feet draft, claim that the present bridges obstruct their use of the river and oblige them to go around instead of through this river; that a yacht's loss of time often carries with it a financial loss; that such loss has already been recognized legally, and that therefore the yacht clubs, as a sort of secondary commerce, are entitled to some considerations in matters of river travel.

It is not merely the extra distance in miles of travel that causes the protest of boat captains against being obliged to go around Newport Island instead of through the Sakonnet River, but it is more especially the fact that the shorter route often avoids head winds, cross tides, the dangerous Brenton reefs (at southwest of island), and exposure to the worst seas of this part of the coast. On this account the short cut, via Sakonnet River, would save not merely 14 miles of travel, but often a whole day's delay of waiting for favorable winds and tides, or of fighting against adverse ones. This may readily be seen by an inspection of the Coast Survey charts. Certainly the Sakonnet River route would be considerably used by schooners and small boats, both of commerce and pleasure, if there was an easy passage for them through the bridges.

Damage already caused.—Accidents and delays to boats at this bridge have been frequent. Among those so reported, the following are prominent: The steamer *Queen City*, with many passengers on board, has several times struck in going through the draw, causing considerable damage and delay. At least one schooner has lost her bowsprit by striking the bridge. Not long ago one man was drowned in the draw through the capsizing of his boat by the swift current.

Admissions by the bridge owners and those who are charged with its repair.—As stated under the head of "History," this bridge is owned by the State of Rhode Island, its care and repair falling, however, by State laws upon the five adjacent towns and cities.

Little Compton, through its town council, at several hearings and by special letter, asks either for the widening or the removal of the bridge by the State or United States.

Tiverton, through its town council, at several hearings and by special letter, asks for a draw of at least 100 feet clear width and at least 20 feet depth.

Portsmouth, through a representative from its town council, agrees with Newport that there is no question of the necessity for alteration of the bridge.

Middletown, through a representative from its town council, agrees with Newport that there is no question of the necessity for alterations of the bridge.

Newport, through its mayor, states that there is no question of the necessity for alteration of the bridges, and that property and life have been imperiled.

The State of Rhode Island, through a representative of its bridge commission, states that commerce and life are endangered, and later the bridge commissioners as a body, in their special report to the general assembly of Rhode Island, state that "it is a notorious fact

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that this bridge is a serious * * * obstruction to * * * navigation * * * and an injury to the commercial and maritime interests of the people * * * and is a source of danger to life and property * * * and practically closes the Sakonnet River to navigation."

PETITIONS.

That the enlargement of this draw is a question of general public demand is plainly shown by the following list of the principal petitioners for such enlargement:

March, 1888: D. T. Church and about 90 others of Tiverton and Providence. (Tiverton being one of the four towns responsible for the repair of the bridge.)

March 24, 1888: John W. Davis (then governor of Rhode Island) and about 100 others of Providence and other places (including many members of the Rhode Island legislature).

April, 1888: Town council and about 170 others of Little Compton, R. I. (Little Compton being one of the four towns responsible for the repair of the bridge.)

The above (about 360 in number) unite in asking for two draw openings, each 100 feet wide and 25 feet deep.

July 23, 1890: D. T. Church and about 70 other citizens of Tiverton and Portsmouth; about 190 masters, pilots, and crews of boats using Sakonnet River; the commodore and about 50 members of Fall River Yacht Club; the commodore and about 60 members of Rhode Island Yacht Club.

The above (about 370 in number) unite in saying that steamers, sloops, and schooners have been seriously damaged and men drowned on account of this bridge draw; and that it sometimes takes from five to six hours to get through one bridge and from ten to twelve hours to get through both bridges, and that this bridge is an obstruction to navigation and danger to life.

March 14, 1891: Julius A. Petty, captain of steamer *Queen City*, formerly schooner captain, states his personal knowledge of loss of life, damage to boats, and loss of time caused by this bridge.

March, April, and May, 1891: Sixty-two captains, masters, pilots of steamers and schooners, by circular letter, claim that on account of the obstructions of these bridges they are forced to go around another way, thereby losing up to 14.5 miles in distance whenever sailing from Narragansett Bay to the east or returning.

February 24 and April 11, 1891: Committee of complainants ask for two draw openings, each 100 feet wide by 25 feet draft.

March 23, 1891: William Reed, jr., and about 100 others, claiming to represent $1,000,000 of capital invested in shipping and real estate affected by the bridge, ask for greater depth and 100 feet width of draws.

HYDRAULIC AND ENGINEERING CONSIDERATIONS.

At the time of the original construction (about 1794) of the State bridge, and up to the date of the construction (about 1860) of the railroad bridge, the State bridge did not offer any special obstruction to the navigation of its time. By reference to the United States Coast Survey tide tables it will be seen that the difference of times between high tide in the Sakonnet River below the bridge and in Narragansett Bay just above the bridge is only about ten minutes, and the corresponding interval at low tides is only about fifteen minutes, so that all day long, excepting at times of special winds, the heights of water on

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the two sides of the bridge were approximately equal, or at most but very slightly different. The flow of water through the bridge opening, as caused by the tide, was therefore comparatively slight. A heavy northerly or southerly wind might of course bank up the water temporarily on one or the other side, and thus cause a considerable difference of head of water and a consequent considerable current through the draw opening, but such effect would be but temporary, and would mainly disappear soon after the temporary blow was completely over. At the worst, there would always be a time once every change of tide—that is, once every six or eight hours—when the water would stand at equal height on both sides of the bridge, when the current would therefore disappear, and when the vessels could consequently pass through the draw without difficulty. Moreover, the vessels of that epoch being far smaller than to-day, their passage through the narrow draw was far safer than otherwise. But by the construction of the railroad bridge the conditions were materially changed.

A reference to the Coast Survey map will show at a glance that the second bridge converted the intermediate waterway (with its connecting "cove") into an inclosed pond of over half a square mile in area, all of which to a height or depth of about 3 feet (the rise and fall of the tide) must be filled twice a day (every tide) and emptied twice a day through the three small openings (only about 100 feet combined total length) of the two bridges. The natural result, as may be verified by anyone, at either draw, any day, has been that during the greater part of each day these draw openings resemble mill races, through which a vessel can pass with difficulty, and rarely without danger. Bearing this point in mind, there is nothing surprising in the statements of complainants that sailing vessels have been carried by the tide across the abutments and wrecked thereon, or that steamboats have sometimes tried six or seven times without success to get through and failed, and have had to wait two or more hours before the current slackened enough to let them through.

Such conditions as these make it imperative that draws should be at least twice as wide as the outside width and much deeper than the draft of the vessels using them. Further, the bottom of the draw opening being of rock and forming a narrow sill across the channel between portions of much greater depth, the depth should be from 3 to 5 feet greater than if this bottom were extensive, level, and sandy, to make allowances for occasional excessive plunging or "scend" of the boats and for the dangerous character of the bottom. Moreover, as the State bridge faces a long southerly reach of water and is exposed to southerly winds from the ocean, a vessel approaching the draw from the ocean side needs far more margin of width for safety than if in a quiet inland river. Under these circumstances I have not the slightest hesitation in stating my professional opinion that a single draw of 100 feet width and 25 feet depth at low tide is the smallest draw consistent with safety for vessels attempting to pass up the Sakonnet River and through the State bridge under ordinary conditions of wind and tide at the present date.

OTHER SPECIAL CONSIDERATIONS.

The location of this bridge close to the Massachusetts State line (only 4 miles therefrom) makes this bridge of almost as much value and use to the large city of Fall River, Mass., and to the other adjacent towns of Massachusetts, as it is to Newport, R. I., and to the other

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adjacent towns of Rhode Island. In the same way, as the Sakonnet River lies only about 4 miles west of the Massachusetts State line, its navigation is of almost as much value to Massachusetts as to Rhode Island, a large part of the inward-bound navigation going to the Taunton River (Massachusetts) towns and a large part of its outward-bound navigation going to Nantucket (Massachusetts) Sound and to other Massachusetts waters; so that this bridge may properly be considered as one concerning at least two States, if not more than two, and is therefore one which very decidedly comes under the provisions of interstate commerce and of Congressional legislation as to "navigable waters of the United States."

The importance of the enlargement of this draw is so great that it has been the subject of the study of a special commission appointed by his excellency the governor of Rhode Island, pursuant to the resolution of the general assembly of Rhode Island at its January session of 1892, with orders to inquire into and report to the general assembly what were the obligations of the State in relation to the stone bridge, so-called, and to the interests of navigation in the Sakonnet River, * * * and to confer with parties in interest in public hearings, or otherwise, and to represent the State in conference with the United States War Department, or its representatives, in all matters relating to said subject. This commission made a thorough investigation of the whole subject, and later discussed the same with the Secretary of War, the Assistant Secretary of War, and the Judge-Advocate-General of the United States Army. The position taken by the said commission is shown by the following extract from their final report to the assembly of the State of Rhode Island at its January session, 1893:

1. The stone bridge is a dangerous obstruction to the navigable waters of the United States; it is owned by this State and has heretofore been and now is maintained under its authority.

2. It is the duty of the State either to make such changes in the bridge as will render it no longer an obstruction to navigation, or to abandon it and permit the United States to clear the river channel.

3. The obligations of the State, however, are not comprised within the limits of its duty to those engaged in navigation and maritime commerce. The State owes a duty also to those who, relying upon the good faith of the State, have paid the expenses of maintaining the stone bridge since the year 1870, and who have by user for nearly one hundred years acquired in the view of justice, if not in strict law, a quasi prescriptive right of way of which the State should not now deprive them. The right of communication with the mainland from the island of Rhode Island has existed for ninety-nine years, and two prosperous towns and the city of Newport have become in some measure dependent upon the use of this highway of the State. These should not now be abandoned, nor should their claims be forgotten or neglected by the State, and the State should find some way to retain for them the communication they now have. On the other hand, the commerce of the city of Providence and the towns of Warren and Bristol will be largely benefited by opening the Sakonnet River to navigation.

The State which gave this right of way and has allowed its towns to grow and become dependent, to whatever extent, upon it, and which will enrich the northern half of its citizens by the proposed abandonment, should bear a commensurate share of the expense toward supplying a new way in place of the old. And your commission is of the opinion that when the United States War Department shall order the changes required to be made in the Old Colony Railroad Bridge, an equitable plan should be devised, if possible, whereby the State and the towns which are interested in the stone bridge may pay their share toward an addition to the railroad bridge suitable for team and foot travel. If such an arrangement as the above can not be satisfactorily made the State may retain its stone bridge by making a suitable draw therein and requiring the United States to clear out the channel of the draw. The State can not expect the United States to pay the expense of making a draw opening and draw for the State's bridge; but the United States can and should be expected to provide the draft of water required for vessels engaged in commerce between and with other States.

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In accordance with the recommendations of this report the general assembly of Rhode Island, at its January session of 1893, passed the following resolution:

Resolved, That permission be, and the same is hereby, granted to the United States of America, and to those acting under their authority, to open through the stone bridge in Sakonnet River a channel of such width and depth as may be desired, in the interest of navigation and commerce between the States, whenever a channel of the like width and depth shall have been made in the railroad bridge across said river at Tiverton, or such changes in said railroad bridge as may be required by the United States in the interest of navigation and commerce, shall have been made. And whenever such changes in the channel at said railroad bridge shall have been made, and the like opening of the channel shall have been made by the United States at the stone bridge, the governor of this State is authorized to execute and deliver to the United States a deed conveying to them the State's rights in the said stone bridge if, and so soon as, he shall have notice that such a deed will be accepted by the United States.

ORDERS OF THE SECRETARY OF WAR WITH REFERENCE TO THE ADJACENT RAILROAD BRIDGE.

Under date of July 1, 1893, the Secretary of War ordered the Old Colony Railroad Company, the then owners of the railroad bridge, to open its drawbridge to 100 feet width, to be completed on or before the 1st of July, 1894.

No particular depth was specified by the order of the Secretary of War, but the requests of the petitioners and the past recommendations of the local United States engineer office (see my report of 8th February, 1893) agree upon a clear depth of 25 feet as necessary to present and future navigation.

CONCLUSIONS AND RECOMMENDATIONS FOR WORK AT THE STONE BRIDGE.

After a study of the past correspondence and records of hearings upon this bridge question, and after a personal inspection of the locality at several different times, I am of the opinion that the travel over this bridge is of minor importance in comparison with the present and probable future travel through it; that the present bridge is an unreasonable obstruction to navigation on account of its insufficient width of span and depth of water, and that it ought to be provided with at least one draw span of at least 100 feet clear width and 25 feet depth at low water. Under all the circumstances of locality, both of bridge and waterway, it seems to me that the bridge and waterway have each so much of an interstate character that it would be perfectly just and proper that the enlargement of the draw opening should be done by the United States, in accordance with the above permission of the State of Rhode Island, after which the State of Rhode Island may be expected to complete the draw opening and draw, in accordance with the recommendations of this State bridge commission and its past provisional promises to the Secretary of War.

I have, therefore, to state my opinion that, for the reasons above given, the stone bridge over the Sakonnet River, Rhode Island, so far as concerns the enlargement of its draw opening to 100 feet clear width and 25 feet clear depth at low water, is worthy of improvement by the General Government.

ESTIMATE OF COST OF SUCH WORK.

From a recent survey it is found that all that is necessary to be done in order to secure this enlarged opening of 100 feet clear width and 25 feet clear depth at low water is the removal of one abutment of the

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present draw, the removal of a short length of the present roadway, and the removal of the rock and earth embankment adjoining to and underneath the present and the newly made opening, so as to leave the necessary clear width and depth. This means the excavation of 11,000 cubic yards of material and its deposit in the adjacent deep water. the cost of this work being estimated as follows:

11,000 cubic yards material removed, at $3 per cubic yard	$33,000
Engineering expenses and contingencies, about 20 per cent	7,000
Total	40,000

Respectfully submitted.

W. H. BIXBY,
Captain, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

(Through Col. Henry L. Abbot, Corps of Engineers, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, January 16, 1895.

Respectfully forwarded to the Chief of Engineers, United States Army.

For the reasons stated in this report I concur with Capt. W. H. Bixby in considering the enlargement of the draw opening of the stone bridge over the Sakonnet River, Rhode Island, to 100 feet clear width and 25 feet clear depth at low water, to be an improvement worthy of execution by the General Government.

HENRY L. ABBOT,
Colonel of Engineers, Brt. Brig. Gen., U. S. A.,
Division Engineer.

C 22.

PRELIMINARY EXAMINATION OF ONSET HARBOR, MASSACHUSETTS.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., May 31, 1895.

GENERAL: In accordance with the river and harbor act of August 17, 1894, and orders from your office dated August 20, 1894, I have the honor to submit the following report upon the preliminary examination of Onset Harbor, Massachusetts.

My opinions, as below stated, are based upon my own personal knowledge and special study of this locality, which was visited by me in person during the past year. This personal visit was used as a check upon such information as has been received by me from various sources during the past year, and also as a check upon the hydrography and topography of the locality as given on the latest Coast Survey charts and local maps.

Onset Harbor, Massachusetts, is a small harbor on the south shore of Massachusetts at the head of Onset Bay, which is itself at the northeastern end of Buzzards Bay. The village of Onset lies within the township of Wareham, and fronts on Onset Bay. Onset is locally well known as a summer camp-meeting ground for social and religious

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purposes, and contains about 400 houses, 60 of them being occupied during the winter, the rest being occupied only during a part of the summer. Its winter population is estimated at about 200 persons and its summer camp-meeting population at about 12,000 on Sundays and about 6,000 during the rest of the week. A horse-car railroad of about 1 mile in length connects Onset with the station of Onset Junction on the Cape Cod branch of the New York, New Haven and Hartford Railroad.

As a result of the occupation of this place by summer camp meetings, the real estate and property valuation of this place, which was estimated in 1879 at only $800, has increased rapidly and so greatly as to be estimated in 1894 at $400,000.

The approach to Onset from Buzzards Bay is through a narrow and winding channel of about 6 miles in length, having a width of from 200 to 1,000 feet and a depth of over 15 feet in its lower half and of over 9 feet in its upper half. This channel, however, practically ends at the end of Onset Bay proper, which is at the beginning of Onset Harbor proper; that is, about a half mile away from the wharves of Onset. Onset Harbor is about a half mile square and has a depth of only from 4 to 7 feet. Above Onset the channel way is continued by a small slough of perhaps a mile total length. The imports of Onset during the past year have been limited to about 1,000 tons of coal brought to the village wharves and the exports to about 6,000 tons of fire sand excavated from a sand bank about a half mile up the above-mentioned slough.

The present importance of Onset Harbor lies in its proximity to the summer camping ground. Some of the Sunday visitors come to Onset by rail, but the larger part, however, come by boat. Two steamboats (the *Nantucket* and *The Island Home*), each capable of carrying from about 800 to 1,100 passengers, and drawing from 5 to 6 feet of water, make excursion trips to Onset from New Bedford and other neighboring points of Buzzards Bay and Vineyard Sound during the summer, especially on Sundays. These boats carried in all about 21,000 passengers during the months of July and August, 1894. Another excursion boat, the *Genevieve*, a boat of about 5 feet draft, 51 feet length, 14 feet breadth, 12 tons net tonnage, 25 tons gross tonnage, and capable of carrying about 75 passengers, runs excursion trips every few hours each day from Onset to the near points of the beach during the continuance of the camp meeting, having in July and August, 1894, carried in all about 9,000 persons. These boats have occasionally grounded in shoal water in Onset Harbor, at perhaps a half mile distance from the village, necessitating the transfer of several hundred passengers to the shore in small boats.

The persons who are interested in the improvement of Onset Harbor desire a channel of from 6 to 9 feet depth to be dredged across their harbor from the wharf fronts to the head of the bay, and a channel of lesser depth to be dredged up the slough to the above-mentioned sand bank.

The desired improvement would undoubtedly be of great benefit to Onset and the immediate vicinity, and of moderate benefit to a few of the neighboring seaside resorts of this State. But as Onset has approximately no commerce in the true sense of the word; as it is merely a seaside resort for pleasure seekers and religious conferences during a very small part of the year; as any improvement of the harbor would be of small and very local benefit to navigation (restricted in this particular case to very small sections of the adjoining bays and sounds), and as the main result of any improvement of this harbor would be to merely

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increase the value of real estate in Onset, while relieving the property owners from the necessity of paying for the work themselves, it appears to me that such an improvement would be so local in its interests, and so little a matter of general interest to the country at large, that, if made, it should be paid for by those locally interested, and not by the United States as a whole.

I have, therefore, to state my opinion, as requested by Congress, that for the reasons above given Onset Harbor, Massachusetts, is not at present worthy of improvement by the General Government.

Respectfully submitted.

W. H. BIXBY,
Captain, Corps of Engineers.

Brig. Gen. WM. P. CRAIGHILL,
Chief of Engineers, U. S. A.

(Through Col. Henry L. Abbot, Corps of Engineers, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, June 7, 1895.

Respectfully forwarded to the Chief of Engineers. For the reasons stated by Captain Bixby I do not regard Onset Harbor as at present worthy of improvement by the General Government.

HENRY L. ABBOT,
Colonel of Engineers, Bvt. Brig. Gen., U. S. A.,
Division Engineer.

C 23.

PRELIMINARY EXAMINATION OF BASS RIVER, MASSACHUSETTS.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., May 31, 1895.

GENERAL: In accordance with the river and harbor act of August 17, 1894, and orders from your office dated August 20, 1894, I have the honor to submit the following report upon a preliminary examination of Bass River, Massachusetts.

My opinions, as below stated, are based upon my own knowledge and special study of this locality, which was visited by me in person during the past year. This personal visit was used as a check upon such information as has been received by me from various sources during the past year, and also as a check upon the hydrography and topography of the locality as given on the latest Coast Survey charts and local maps.

Bass River is one of the small rivers on the south shore of Cape Cod Bay, between Hyannis and Chatham, and empties into Nantucket Sound about 5 miles east of Hyannis.

Cape Cod at this neighborhood is only about 6 miles wide, with Cape Cod Bay on the north and Nantucket Sound on the south, and its surface consists mainly of sand hills and sand flats with occasional ponds and marshes, the inland ponds being mostly of fresh water, while the other ponds and marshes near the bays and sounds are of salt water. The soil of this region is not well adapted to cultivation except to that of cranberries, very little ordinary farming being done. Most of its corn,

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wheat, hay, and other similar supplies have to be brought from a distance. Consequently this section of the country has a very small and scattered population, and at the present time depends largely for its support upon the cranberry culture in the fall, and the hotels, boarding houses, and summer cottages during the rest of the year. There are but few manufacturing establishments anywhere in the neighborhood, and these few are small in size. Almost all the cottage towns and settlements along the adjoining shore fronts are supplied with small wharves directly on the bay or sound, suitable for use by light-draft vessels during the summer season. The cold weather and the ice prevent the use of these wharves along this part of the coast during the winter season. The main supplies of this section of the coast are therefore carried to it by the Cape Cod branch of the Old Colony Railroad, which at this point runs along the center ridge of the cape almost half way between Cape Cod Bay on the north and Nantucket Sound on the south. Naturally with such a small permanent population, with but little in the way of farming interests and manufacturing interests and with a summer population mainly composed of visitors, the commercial interests of the neighborhood are exceedingly small and local, and it is apparent that the United States Government improvements must be limited to the improvement only of the largest and most important harbors. Hyannis Harbor, which is only 5 miles west of Bass River, has naturally a fairly good anchorage for vessels of 15 feet draft, and has a large bay adjoining it suitable for vessels of smaller draft. Hyannis Harbor has therefore received a good deal of assistance from the General Government, the cost of such assistance up to the present time being about $150,000, by which it has been provided with a breakwater of over 1,000 feet length, and with a well-protected anchorage ground, in rear of this breakwater and in front of Hyannis Wharf, covering over 150 acres and having a draft of 15 feet. Because of the existence of this natural harbor at Hyannis (and its improvement by the General Government), the Cape Cod Railroad has constructed a branch line to its harbor and wharves, allowing the easy landing of all heavy supplies such as iron, coal, grain, etc., for general distribution to the adjacent section of Cape Cod.

About sixty years ago, before the construction of the existing railroad line through this region, Bass River was a place of considerable importance to this neighborhood, and was the center of a large amount of shipping, principally composed of whaling vessels. In those days as many as 150 vessels are reported as having been laid up in the river every winter. In consequence of the commercial importance of this place at that time, the United States, under river and harbor appropriations, expended about $20,000 between 1837 and 1840 outside the mouth of this river in the construction of a breakwater of about 250 feet length, to serve as a shelter to vessels of from 6 to 12 feet draft; and later on, in 1854–55, the Light-House Department constructed a light-house on the breakwater at a further expense of $4,000. Since that date the whaling interests have almost entirely died out, and the adjoining better harbor of Hyannis, combined with the construction of the Hyannis branch of the Old Colony Railroad, has diminished the local importance of Bass River so that its commerce is at present very small. Further than this, the shifting sand of this neighborhood have built up shoals in rear of the breakwater and around its harbor so that it is now possible at low water for a man to wade without difficulty from the breakwater to the shore on either side of the entrance to the

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river. Boats at present lying in what is left of the anchorage behind the breakwater can not go directly into the mouth of the river, except by passing over a shoal of about 0.75 mile length with an average depth of only 0.5 foot at low water. In order to get from the breakwater harbor to the mouth of the river by the best boat channel, boats must now first sail 1.5 miles westward from the breakwater and then enter the river by a narrow and winding entrance, having at its shoalest point (its outer bar) hardly 2 feet depth at low tide. Owing to the marked decrease of the commerce of this river, and of its usefulness to navigation, the Light-House Department in about 1881 removed its light from the breakwater to the adjacent shore, retaining the breakwater itself as a front range to the shore light for the use of vessels approaching the river entrance and the breakwater harbor. At present, however, the main utility of this breakwater is as a popular fishing place for summer visitors.

Bass River itself, from its source to its mouth, is only about 7 miles long, the upper 3 miles consisting mainly of large ponds, and the lower 4 miles having a reasonably good channel of 40 to 50 feet width and of 5 to 7 feet depth at low water down to the apparent mouth of the river, that is, to the general line of the shore front of Nantucket Sound. Outside of this shore line lies a shoal of from 2,000 to 8,000 feet length, the shallowest portion of which constitutes the outer bar of the river mouth, and lies about 1.5 miles in front of the general shore line.

The Old Colony Railroad crosses Bass River just below the upper ponds and about 3 miles from the head of the river, by a bridge about 50 feet wide, leaving a waterway under it of about 40 feet clear width and 12 feet clear height. From the railroad downstream, a distance of about 0.75 mile to the South Dennis Highway Bridge, the river varies from 50 to 600 feet in width, with a boating channel of perhaps 40 feet width and 5 or 6 feet depth at low water. The South Dennis Bridge is about 180 feet long, and is without any draw, but has a boating span of about 20 feet width and 10 to 12 feet height at low water. From the South Dennis Bridge down a farther distance of about 2 miles to the South Yarmouth and West Dennis Bridge the river varies from 200 feet to 3,000 feet in width, with a boating channel of about 50 feet width and 6 to 7 feet depth at low water. The South Yarmouth and West Dennis Bridge is about 600 feet long, with a good draw of 30 feet width. From the South Yarmouth Bridge 1.5 miles farther to the apparent mouth of the river the river varies from 300 to 800 feet in width, with a good boating channel of about 50 to 60 feet width and about 6 to 7 feet depth at low water. From the apparent mouth of the river to its outer bar in Nantucket Sound, i. e., to the deep water of Nantucket Sound, the distance is about 1.5 miles, measured along the boating channel, this channel, as marked by stakes (cut down by the ice each winter and replaced every spring) being from about 60 to 600 feet in width; the depth on the outer bar (a few hundred feet from deep water of the sound) being a little less than 2 feet; the distance from 3 feet depth outside of the bar to 3 feet depth inside the bar at low water being about 2,000 feet; and the distance from 6 feet depth outside the bar to 6 feet depth inside the bar at low water being from 5,000 to 6,000 feet. The bottom is everywhere of shifting sand, and the boat channel is continually changing its position from year to year. The local conditions cause a difference of about an hour between the times of low tide and of slack water; and the movement of the tidal currents are so slow that there is an interval of nearly three hours between the times

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of low tide on the outer bar and of low tide at the South Yarmouth bridge, the distance between the two places being only about 3.5 miles.

There are very few settlements around the upper part of Bass River, north of the Old Colony Railroad, the nearest village being that of Yarmouth, about a mile from the head of the river. Yarmouth, however, is less than a mile distant from Yarmouth Port, on Barnstable Harbor, Cape Cod Bay, and consequently Yarmouth commerce naturally seeks an outlet to the ocean through Cape Cod Bay and not through Bass River. South of the Old Colony Railroad, on the east side of Bass River and close to it, lie the villages of South Dennis and West Dennis. South Dennis is a place of only about 700 population, its center lying about 0.25 mile distant from the railway station, and also about 0.25 mile distant from the river. West Dennis is a place of about 800 population, its center being about 2 miles southwest of South Dennis, about a half mile from the nearest point of the river, and about 2 miles from the mouth of the river. The half township of Dennis south of the railroad contains another settlement called Dennisport, a place of about 900 population, lying directly on the shore front of Nantucket Sound and having wharves that run directly out into 6 feet depth of water in this sound. As Dennisport is only about 2.5 miles from South Dennis and the same distance from West Dennis, it might easily serve as a port of entry for all three places, as it undoubtedly used to do fifty years ago; but Dennisport is at present mainly a seaside resort for summer residents, and its wharves are used mainly by the small boats of such summer residents. On the west side of Bass River and between the Old Colony Railroad and Nantucket Sound, the only settlement of any size is South Yarmouth. South Yarmouth is a village of about 900 population, lying directly on the bank of the river about 1.5 miles from its mouth, about 2 miles from the South Yarmouth Station, on the Old Colony Railroad, and directly opposite West Dennis. The river channel at this point lies on the South Yarmouth side of the river, and the draw in this South Yarmouth and West Dennis Bridge is consequently close to South Yarmouth. South Yarmouth and South Dennis each possess one wharf, used by two-masted sailing packets of from 5 to 6 feet draft and of from 20 to 30 tons cargo. During about nine months of the year one of these boats leaves each wharf for New York about once every ten days, i. e., each boat makes about twenty-five trips during each year. The cargo of these boats is mainly coal, grain, hay, and other similar supplies, and the two boats seem to easily carry all the commerce of the neighborhood. Either of these boats could easily go through the ship draw and up the river 2 miles farther to South Dennis, but neither of them appear to ever make any such trips, evidently because there is no demand for such service. As these boats draw from 5 to 6 feet of water—more than there is on the sound bar at low water—they, of course, arrange their trips so as to pass over the bar at high tide; but as the delays on the bar only occur once in ten days, and then for only a few hours at a time, it is naturally not a very serious detriment to the commerce. However, these boats would, of course, like a better channel over the bar; but the main demand for such improvement comes from the summer cottage population, who desire free passage for their pleasure boats across the bar at all stages of the water. Any improvement to be of decided benefit to even the pleasure boats would require the dredging of a channel of about 2,000 feet length and of 3 feet depth at low water, while to be of decided benefit to the sailing packets the channel should be dredged to about

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5,000 feet length and 6 feet depth at low water. Both channels would require their banks to be protected by revetments of either piling or of stone. The extensive sand shoals of the neighborhood, and the continual shifting to which the channel has always been subject, would render useless any dredging unless the channel was protected by side revetments; and there would be no reasonable hope of keeping the channel permanently within these revetments unless the latter were made quite solid and were carried well up upon the shore at the shore end, and also well out into deep water outside of the outer bar. The cost of any such work appears to be entirely out of proportion to the commerce of this river, either present or prospective.

The desired improvement would undoubtedly be of great benefit to the immediate neighborhood and of moderate benefit to the few adjoining settlements, but it appears to me from the reasons above given that such an improvement would be so extremely local in its interests and so little a matter of general interest to the country at large that if made it should be paid for by those locally interested and not by the United States as a whole.

Moreover, it is now quite probable (the bill already having gone to its third reading) that the State of Massachusetts will soon authorize the construction by private parties of a canal across Cape Cod from Nantucket Sound to Cape Cod Bay via Bass River. In such case, the route selected for this canal will in all probability leave Nantucket Sound near the deep water in rear of the Bass River Breakwater, and will therefore not only pass at least a mile east of the present entrance to Bass River, but will also serve as an entirely new entrance to this river. Under such circumstances, even large annual expenditures for dredging will be insufficient to keep open any improved channel at the present entrance to this river; so that any work which may be done at the present time at the present entrance to Bass River for its improvement will necessarily soon become of small local value, and even then will give no permanent results.

I have, therefore, to state my opinion that for the reasons above given Bass River, Massachusetts, is not at present worthy of improvement by the General Government.

Respectfully submitted.

W. H. BIXBY,
Captain, Corps of Engineers.

Brig. Gen. WM. P. CRAIGHILL,
Chief of Engineers, U. S. A.

(Through Col. Henry L. Abbot, Corps of Engineers, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, June 7, 1895.

Respectfully forwarded to the Chief of Engineers.

For the reasons stated by him I concur with Captain Bixby in regarding the improvement of Bass River as unworthy to be undertaken by the General Government.

HENRY L. ABBOT,
Colonel of Engineers, Bvt. Brig. Gen., U. S. A.,
Division Engineer.

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C 24.

PRELIMINARY EXAMINATION OF HYANNIS HARBOR, MASSACHUSETTS.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., May 31, 1895.

GENERAL: In accordance with the river and harbor act of August 17, 1894, and orders from your office dated August 20, 1894, I have the honor to submit the following report upon a preliminary examination of Hyannis Harbor, Massachusetts:

The harbor of Hyannis lies on the south shore of the peninsula of Cape Cod, about 15 miles to the westward of the heel of the cape, and is an important harbor of refuge for this vicinity, especially from the fact that it is the only place within 30 miles of the heel of the cape (Pollock Rip) where fuel and water can be supplied to steamers of moderate draft.

This harbor is already under general improvement by the Government. In 1827–1838 a breakwater 1,170 feet long, covering an anchorage of 175 acres, was constructed about 500 yards in advance of the main wharf of the harbor. The present approved project, that of 1884, now nearly completed, provides for an increase in the extent of the 15.5 feet anchorage in rear of the breakwater. Since 1884 the harbor has been a great deal used by the light-house tenders and other steamboats (about 900 entries per year), which enter the harbor largely for the purpose of obtaining fuel and water, and also by small craft (about 3,000 entries per year) which bring freight and supplies to this section of Massachusetts. The commerce is at present reported as about 21,000 tons, or $240,000 worth. (For further particulars see pp. 571–573, Annual Report Chief of Engineers, 1894.) The present approved project will give all the deep-water depth at present needed in rear of the breakwater.

There is, however, an increasing demand for an extension of the harbor nearer to the wharves for the light-draft boats that are now extensively using the harbor, and for the removal of a small shoal which is nearly in line between the harbor entrance and the end of the main wharf, and which to a considerable extent diminishes the area of the harbor for small-draft vessels. Some further dredging is also necessary in order to allow the small boats to approach the wharf, from which they can obtain the desired fuel and water. The total amount of dredging still necessary to make this harbor available for the smaller class of boats now needing to get closer to its wharves is therefore not only small, but also the nature of the neighboring bottom, as found in former dredging in this vicinity, renders it very likely that such work of improvement can be easily and cheaply done. The increasing use of this harbor, in connection with the fact that there is no other harbor within reasonable reach of it, makes me regard these demands as worthy of special consideration.

I have therefore to state my opinion that, for the reasons above given, this harbor is worthy of further improvement by the General Government, and to submit an estimate of $600 as an amount necessary for a proper survey and report, including project and estimate of cost of the improvement proposed.

Respectfully submitted.

W. H. BIXBY,
Captain, Corps of Engineers.

Brig. Gen. WM. P. CRAIGHILL,
Chief of Engineers, U. S. A.

(Through Col. Henry L. Abbot, Corps of Engineers, Division Engineer Northeast Division.)

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[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, June 7, 1895.

Respectfully forwarded to the Chief of Engineers. For the reasons stated by Captain Bixby I regard the harbor of Hyannis, Mass., as worthy of further improvement by the General Government.

HENRY L. ABBOT,
Colonel of Engineers, Brt. Brig. Gen., U. S. A.,
Division Engineer.

C 25.

PRELIMINARY EXAMINATION OF CONANICUT ISLAND, RHODE ISLAND, WITH A VIEW OF CUTTING A CHANNEL THROUGH THE SAME.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., May 31, 1895.

GENERAL: In accordance with the river and harbor act of August 17, 1894, and orders from your office dated August 20, 1894, I have the honor to submit the following report upon the preliminary examination of Conanicut Island, Rhode Island, with a view of cutting a channel through the same.

My opinions, as below stated, are based upon my own personal knowledge and special study of this locality, which was visited by me in person during the past year. This personal visit was used as a check upon such information as has been received by me from various sources during the past year and also as a check upon the hydrography and topography of the locality as given on the latest Coast Survey charts and local maps.

Conanicut Island is an island of about 9 miles length and of about 1 mile average breadth, lying at the southern entrance of Narragansett Bay and dividing this entrance into two channels, called, respectively, the Eastern passage and the Western passage. The Eastern passage separates Conanicut Island from Newport and has a width of from 0.75 mile to 2.5 miles and a channel depth of from 60 to 150 feet. The Western passage separates Conanicut Island from North Kingstown township and the district of Narragansett and has a width from 0.75 mile to 1.5 miles and a depth of from 30 to 70 feet.

All the commerce going through Narragansett Bay on its way from the ocean to Providence must pass through either the Western passage or the Eastern passage, the greater portion passing the Western passage. Some of the Providence commerce and all the Newport, Taunton, and Fall River commerce (including that of the Fall River steamboats) goes through the Eastern passage. The Providence commerce is estimated at over 1,000,000 tons (about $30,000,000), and the Newport, Fall River, and Taunton commerce is estimated at about 1,800,000 tons (about $140,000,000).

In the township of North Kingstown and opposite the north end of Conanicut Island is the village of Wickford, a place of about 900 population, with a fairly good harbor, which has already been improved by the General Government to 9 feet depth at low water. Wickford, a terminus of a short railroad connecting with the New York, New Haven and Hartford Railroad, has a steamboat connection with Newport

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(around the north end of Conanicut Island) so as to accommodate through travel between New York and Newport. This steamboat makes five trips daily each way during the winter and seven trips each way during the summer. This boat is of medium size, well protected against the weather, makes its trips regularly and quickly, and has a capacity for a great deal more travel than it is ever called on to serve. The commerce of Wickford is already about 50,000 tons ($300,000), and the further improvement of its harbor is already in progress by the Government.

In the district of Narragansett and about a mile south of the south end of Conanicut is another small village called Narragansett Pier, a place of about 1,000 permanent population, and having a small harbor and a limited wharf front. Narragansett Pier is specially known as a large and fashionable watering place, with a large, variable summer population of several thousand. Narragansett Pier is also a terminus of a short railroad connecting with the New York, New Haven and Hartford Railroad, and has a steamboat connection with Newport (around the southern end of Conanicut Island) to accommodate special travel between the Pier and Newport. This steamboat runs only during the summer, and then it makes four trips each way daily. The boat is of smaller size than the Wickford boat, is not so specially well protected against the heavy seas which it occasionally has to meet, and its landing at Narragansett Pier is not specially well protected during very rough weather, but still this boat usually makes its trips regularly and quickly, is rarely delayed by the weather, and has a capacity for a good deal more travel than it is usually called upon to serve.

Also in the township of North Kingstown and west of the center of Conanicut Island is a small village called Saunderstown, containing, perhaps, 15 to 20 houses, mainly occupied during the summer season by seaside visitors. About a mile south of Saunderstown, but in the district of Narragansett, is a landing place called South Ferry, the western terminus of a small steam ferry crossing the Western passage at this point and allowing people who drive from Narragansett Pier to cross over to Conanicut Island. This ferry from Conanicut to Narragansett makes six trips daily each way in the summer time, and is replaced by a sailboat in the winter time, the travel not being sufficient to warrant an expenditure necessary for the continuance of the steam ferry.

In the middle of the Western passage and opposite Saunderstown and South Ferry is an island belonging to the United States called Dutch Island. The portion of the Western passage lying between Dutch Island and Conanicut is called Dutch Island Harbor. This harbor is about 0.75 mile square, with a depth varying from 14 up to 50 feet, and forms a safe harbor of refuge in severe gales for the larger sailing vessels navigating the Western passage. The ferry connecting Narragansett with Conanicut has its Conanicut terminus within this harbor.

On Conanicut Island, at about its central point and directly opposite the city of Newport, is the village of Jamestown, a place of about 200 to 300 population in winter, increased by a variable summer population of 1,000 to 2,000, who spend a few months of the year in its hotels and cottages. Jamestown is connected with Newport by a large steam ferryboat which makes ordinarily six trips each way each day in winter and ten trips each way each day in summer. Persons desiring to drive from Newport to Narragansett Pier or who wish to avoid the rough sea that they might encounter on the Narragansett Pier steamboat can go from Newport to Jamestown on the Newport ferryboat, then drive 1 mile

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across Conanicut Island, then go from Conanicut Island to the west shore of the Western passage on the Narragansett Ferry, and then drive 6 or 7 miles farther down the main shore to Narragansett Pier. This route is not used by commerce, but is to a small extent followed by pleasure parties in the summer. Both ferries have accommodations for carriage travel.

About a mile above Jamestown Conanicut Island is almost cut in two by a salt-water slough and marsh. The head of this slough is within a quarter of a mile of the eastern shore of Conanicut Island—that is, of the west side of the Eastern passage—and the western end of the slough connects directly with Dutch Island Harbor. The marsh itself is about a quarter of a mile in width and the slough averages about 50 feet in width, with a depth of from 1 to 3 feet at low water. One of the public highways of Conanicut Island crosses the marsh and slough at about its middle point, while another of these highways runs between the head of the slough and the eastern shore of the island. In extreme high water it is probable that the marsh is so overflowed that all connection between the upper and lower part of the island would be entirely cut off were it not for these two causeways. It is at this point that some of the people of the neighborhood desire a channel cut across the island.

The object of cutting this channel across Conanicut Island, as stated by its advocates, is fivefold: First, to enable pleasure boats and other craft to pass directly from the middle of the Eastern passage into the middle of the Western passage without going around either end of Conanicut Island, thereby saving them at the utmost about 8 miles distance by boat; second, to enable the two steam ferryboats, one from Newport to Jamestown and the other from Jamestown to Narragansett, to be replaced by a single line of ferry, which could go through the canal and thereby enable travelers from Newport to Narragansett to avoid the 1-mile carriage transfer across Conanicut Island; third, to facilitate the establishment of a rival line of combined steamboat and railroad travel from Newport to the New York, New Haven and Hartford Railroad, the steamboat to follow the newly established ferry line and to connect at some point near Saunderstown with a new branch railroad possibly to be built at some future date (the advocates of this new short cut claiming that it might be an improvement on the present Wickford line and might reduce the time between Newport and New York by possibly as much as a half hour); fourth, by the establishment of the new ferry line through the canal to develop idle real estate on the western shore of Conanicut Island and on the eastern shore of Kingstown and Narragansett, in the neighborhood of Saunderstown and South Ferry, and fifth, by the development of this ferry and real estate to increase the local trade of Newport.

A cut of a mile length with 60 feet width and 6 feet depth at this point would accommodate small pleasure boats and small ferryboats, a cut of 100 feet width and 10 feet depth would accommodate the large ferryboats and moderate sailing craft, and a cut of 100 feet width and 15 feet depth would allow the passage of all boats such as now use Newport Harbor. Any other canal cut across Conanicut Island at any other location would require about the same length (about a mile) of cutting, and would be more expensive as to construction and less advantageous, and less desirable also to the persons who are advocating such work. Both ends of this canal would probably require to be protected by short jetties extending from at least high-water mark out

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into deep water (from 1,000 to 3,000 feet total length for all the jetties), according to the depth of water to be secured. Otherwise both entrances of the canal would be liable to a certain amount of shoaling and liable to require constant redredging in order to maintain them at full depth.

However, there is no reason to suppose that any of the through travel to Providence, Taunton, Fall River, or Newport would ever make use of this canal, because it would not be either as good, as safe, or as short a route as that already in use by them. Next, as the present steam ferries from Newport to Wickford, Newport to Jamestown, Jamestown to Narragansett, and Newport to Narragansett Pier already furnish good accommodations far in excess of the demands of present travel, there does not seem to be any special need of a fourth route from Newport to the west shore of Narragansett Bay. Furthermore, the use of this channel by summer pleasure boats, the improvement of Conanicut and Narragansett real estate, and improvement of the summer local trade of Newport, all these are matters that do not carry any special benefits outside their own limited locality, not even to the rest of the State of Rhode Island, and much less to the rest of the United States. The desired improvement would undoubtedly be of great local benefit to Conanicut Island and its immediate vicinity, but it appears to me that the construction of any such new route, either as a rival to the three existing steam ferry lines, or as a rival to the existing Wickford boat and railroad connection with the New York, New Haven and Hartford Railroad, or as a step toward the development of the adjoining land properties, or as a step toward a small increase in the local trade of Newport, would be so local in its interests and so little a matter of general interest to the country at large that, if made, it should be paid for by those locally interested and not by the United States as a whole.

I have therefore to state my opinion, as requested by Congress, that, for the reasons above given, Conanicut Island, Rhode Island, as regards cutting a channel through the same, is not at present worthy of improvement by the General Government.

Respectfully submitted.

WM. H. BIXBY,
Captain, Corps of Engineers.

Brig. Gen. WM. P. CRAIGHILL,
Chief of Engineers, U. S. A.

(Through Col. Henry L. Abbot, Corps of Engineers, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, June 7, 1895.

Respectfully forwarded to the Chief of Engineers. For the reasons stated by Captain Bixby I concur with him in regarding the channel across Conanicut Island as an improvement not worthy of being undertaken by the General Government.

HENRY L. ABBOT,
Colonel of Engineers, Bvt. Brig. Gen., U. S. A.,
Division Engineer.

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C 26.

PRELIMINARY EXAMINATION OF SEACONNET POINT, RHODE ISLAND.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., May 31, 1895.

GENERAL: In accordance with the river and harbor act of August 17, 1894, and orders from your office dated August 20, 1894, I have the honor to submit the following report upon a preliminary examination of Seaconnet Point, Rhode Island:

Seaconnet Point is a rocky headland on the eastern side of the entrance to the Seaconnet River and lies about 6 miles east of Newport. The Seaconnet River itself is an arm of the sea serving as the eastern entrance to Narragansett Bay and is a stretch of water of about 14 miles in length and of about a half mile width at its extremity, where it connects with Narragansett Bay, and of about 2 miles width at its southern extremity, where it adjoins the Atlantic Ocean. It is navigable throughout its entire length at low water for vessels drawing 24 feet, and its lower portion forms a natural harbor of refuge several miles square against all winds except those coming directly from the Atlantic. It is useful as a refuge during storms from the east and southeast, in which case an area of at least 2 square miles is available to vessels drawing over 30 feet depth of water, which can ride in safety behind a protection offered by the headland of Seaconnet Point. Because of this protection against easterly and southeasterly winds the mouth of the river is much used by fishing vessels, which desire to be as near as possible to their fishing grounds in this neighborhood. During heavy southerly winds these vessels, as well as many other larger vessels which are passing by this locality, are obliged to either seek shelter behind the point or to sail many miles further up the river. There are at present no convenient wharfage facilities in this neighborhood, although this section of the country has been rapidly increasing in population for many years past.

A line of steamboats from Providence to Seaconnet Point runs daily through the winter (when not prevented by ice and bad weather) and at least twice a day in the summer, landing about 3,600 tons of freight (about $90,000 worth) and also about 10,000 passengers, and this steamboat line would undoubtedly carry a much larger commerce if there were better facilities for its landing and harborage near Seaconnet Point.

The necessity for some local protection has been evident for a long time. Even as far back as 1827 a project was prepared by Lieutenant Anderson, of the Topographical Engineers, for a breakwater 400 feet long at this point, and about 200 feet of such breakwater was apparently built at or about that time. A map of this point showing the breakwater is already on file in your office. This small breakwater is by no means large enough to afford sufficient shelter to the vessels which often are forced to lie behind it. At the time of my inspection of this locality the protected portion of this harbor was already filled by small boats.

The people of the neighborhood are desirous of having this old breakwater extended and raised so as to give safe and more extended protection in all directions of wind, and especially at high tides; and they also desire the marking or removal of a few isolated rocks covered at high or low water on the north and east of the present wharf and only a few hundred feet distant therefrom. As it is at present, steamboats

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are not always able to make a landing here, and even sailboats are at times unable to remain in the neighborhood of the point for want of proper protection.

The recent need of such work at this point has been such that the matter was brought to the attention of Congress in 1888, and the river and harbor act of August 11 of that year provided for an examination of this locality with respect to its improvement by the General Government, with the result that it was reported by my predecessor, Maj. W. R. Livermore, to the Congress of 1889 as being "worthy of improvement by the General Government," such report being concurred in by the Chief of Engineers. (See p. 649 and p. xiv, Annual Report Chief of Engineers, 1889.)

Major Livermore in his report stated "that this is the only landing place on the shores of Little Compton; it is important to the fishing interests, and if protected by a breakwater would form a convenient harbor of refuge for small vessels navigating this portion of the coast." My own personal examination of this place leads me to confirm my predecessor's opinion and to add that the reasons which made a small breakwater and harbor specially desirable at this point in 1827 and 1888 make it even more desirable at the present date.

I have therefore to state my opinion that for the reasons above given this locality is worthy of improvement by the General Government, and I have further to submit an estimate of $600 as an amount necessary for a proper survey and report, including project and estimate of cost of the improvement proposed, as required by existing laws.

Respectfully submitted.

W. H. BIXBY,
Captain, Corps of Engineers.

Brig. Gen. WM. P. CRAIGHILL,
Chief of Engineers, U. S. A.

(Through Col. H. L. Abbot, Corps of Engineers, Division Engineer Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, June 7, 1895.

Respectfully forwarded to the Chief of Engineers. For the reasons stated by him I concur with Captain Bixby in regarding Seaconnet Point as worthy of improvement by the General Government.

HENRY L. ABBOT,
Colonel of Engineers, Bvt. Brig. Gen., U. S. A.,
Division Engineer.

C 27.

SURVEY OF WOODS HOLE AND LITTLE WOODS HOLE HARBOR, MASSACHUSETTS.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., August 17, 1895.

GENERAL: In accordance with the provisions of the letter from your office dated September 1, 1894, I have the honor to submit herewith a report upon a survey of Woods Hole and Little Woods Hole Harbor, Massachusetts, as provided for by the river and harbor act of August

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17, 1894, including therewith a detailed project and estimate of cost of improvement. The field work of this survey was done under direction of this office during June, 1895, by a small surveying party under the local charge of Mr. J. H. Rostock, assistant engineer.

Description.—Woods Hole is the name given to an important waterway and neighboring harbor on the southwestern part of the peninsula of Cape Cod, Massachusetts, and lying between the mainland and the first of a long chain of islands extending to the southwest. It is a sheltered connection between Buzzards Bay and Vineyard Sound and at present is used by many vessels from New Bedford and points in Buzzards Bay to Marthas Vineyard and Nantucket and other eastern ports. The harbor of Woods Hole consists of two parts, Great Harbor, which is used principally by the United States Fish Commission, a large wharf and basin having been built by the United States in 1883–84 for its express benefit, and Little Harbor, which lies adjacent to the greater harbor and is the location of some docks and repair shops belonging to the United States Light-House Department, being used at present by but little else. The depth of adjacent water on each side of this strait or passage of Woods Hole is sufficient for vessels drawing up to 18 feet, but the many rocks and the winding passage combined with the swift currents make navigation very difficult except at slack water, and then only for vessels drawing less than 8 feet.

This passage is approximately 2,500 feet long and 1,600 feet wide, but the channel, however, is somewhat winding and much narrower, being only about 150 feet wide at some places. The times of high tide in Buzzards Bay and Vineyard Sound, on opposite sides of this short strait, differ by from three to four hours, thus rapidly and frequently changing the head of water from one side to the other, causing very strong and complex currents.

The shores along this vicinity and some accessible shoal places are found to be composed of tightly compacted round bowlders of varying sizes from 1 foot to 6 feet in diameter, being in some places also firmly cemented in a stiff clay. Borings recently taken and previous work in this vicinity indicate that the bottom is composed of the same material, no true ledge rock having been found and none being thought to exist. This special locality was first examined with a view to its improvement in 1874 by General Warren, of the Corps of Engineers, who reported favorably upon the worthiness of the place for Government improvement. (See p. 275, Annual Report Chief of Engineers for 1875.) In 1879 about $10,000 was spent in much needed work of removing some of the worst bowlders, which work has since proved to be of great value. The increased needs of present commerce now require that more of this same work of widening, deepening, and straightening should be done to provide a better and safer communication through this waterway.

In 1893 Captain Bixby, of the Corps of Engineers, also made an examination and report, saying that this waterway was "specially worthy of immediate and extensive improvement," and estimated a possible commerce through it after suitable improvement of about 500,000 tons, valued at from $5,000,000 to $20,000,000. (See p. 860, Annual Report Chief of Engineers for 1893, where a fuller description may be found.)

In 1879 also a small amount of dredging was done in Little Harbor to improve this harbor, principally to enable the United States Light-House Department's vessels to more easily reach their docks and incidentally

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also for the benefit of other vessels. This work has remained reasonably permanent, furnishing a good channel of 9 feet depth at low water up to the United States Light-House Department wharves, with about 6 to 7 feet depth of water up to the head of the bay, so that no further work by the United States in this small bay is now deemed necessary or advisable.

Plans of improvement.—The inclosed map* shows the location of the proposed channel connecting Great Harbor, Woods Hole, with Buzzards Bay, having a short southern branch (locally called "Broadway") for the further convenience of the through travel into Vineyard Sound. It is proposed to give this channel and its southern entrance a width of 300 feet and a low-water depth of 13 feet to enable vessels drawing 12 feet to use it.

Cost.—Previous work at this place shows that the bowlders forming the bottom and sides of this waterway may be usually grappled and dredged, but that many may first require blasting. The swift currents and the short available working hours render this work comparatively expensive.

From the previous work in 1879 and from the cost of similar work at the present time, it does not seem likely that small bowlders containing up to 2 cubic yards could be removed for less than $8 per cubic yard and those large bowlders that have to be blasted for less than $10 per cubic yard. It is estimated that to straighten, deepen, and widen this channel as herein planned would require the excavation of about 30,000 cubic yards of small bowlders (less than 2 cubic yards each) and 9,000 cubic yards of larger bowlders.

30,000 cubic yards excavated, at $8 per cubic yard	$240,000
9,000 cubic yards excavated, at $10 per cubic yard	90,000
20 per cent, superintendence and contingencies	66,000
Total	396,000

This estimate is based on the supposition that work will be carried on as fast as is advantageous and economical to the Government, thus requiring, from the locality and nature of the work, a probable expenditure of about $100,000 each working season until work is completed, or two successive biennial appropriations of about $200,000 each. Smaller appropriations than the above will materially increase the ultimate cost of the work.

In view of the considerable and immediate benefit which this improvement would likely afford general navigation, I have to recommend that this improvement be placed among those whose final completion may be contracted for at once and for which appropriations are made annually.

Very respectfully, your obedient servant,

WM. W. HARTS,
First Lieut., Corps of Engineers.

Brig. Gen. WM. P. CRAIGHILL,
Chief of Engineers, U. S. A.

(Through Division Engineer, Northeast Division.)

* Not printed.

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[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
Washington, August 31, 1895.

Respectfully forwarded to the Chief of Engineers, concurring in the views and recommendations of Lieutenant Harts, with the exception of the suggestion contained in the closing paragraph, that the improvement shall be classed among those for which appropriations are made annually, and for the final completion of which a contract can be made at once.

JOHN M. WILSON,
Colonel, Corps of Engineers, Division Engineer,
Northeast Division.

C 28.

SURVEY OF WICKFORD HARBOR, IN NARRAGANSETT BAY, RHODE ISLAND.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., September 4, 1895.

GENERAL: In accordance with the provisions of the letter from your office dated September 1, 1894, I have the honor to submit herewith a report upon the survey of Wickford Harbor, Rhode Island, as provided for by the river and harbor act of August 17, 1894, including therewith a detailed project and estimate of cost of its improvement. The field work of this survey was done under direction of this office during July, 1895, by a small surveying party under the local charge of Mr. J. H. Rostock, assistant engineer.

Description.—Wickford Harbor is an arm of Narragansett Bay lying in its northwestern part, about 18 miles south of Providence, R. I., and about 12 miles northwest of Newport, R. I. This harbor is a small one, its entrance being only about a fourth of a mile wide. The entrance and its approaches are obstructed by a number of large bowlders nearly all of which are submerged at all stages of the tide, making the navigation of the vicinity difficult and dangerous. Some of the more prominent of these rocks have long been a source of complaint, several vessels having been badly injured thereon during fogs within the last few years. The harbor itself is made up of two branches, one extending to the northward and the other to the southward. The northern branch is very little used and at present requires no improvement for navigational purposes, being more than able to accommodate all the small craft now needing to use it. The southern branch, however, is where improvement is desired at present, being used considerably, as it is the only water approach to the neighboring town of Wickford. This town has only about 4,000 inhabitants, but is of considerable commercial importance, having many factories and a reported business of about $2,750,000 per year.

Near the entrance to this harbor is the steamboat landing, which is the terminus of a short line of railway connecting with the shore line of the New York, New Haven and Hartford Railroad at Wickford Junction, and which is also the landing place of a steamboat line connecting with Newport. From this landing a winding channel of about 6 feet average depth at low water leads up to the town wharves through the

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southern branch of the harbor, a distance of about a mile. It is reported that, due to the increasing size of barges and other freight vessels of late years, this branch can not be used as much as formerly, so that coal and many other supplies can not be landed at Wickford, but have to be transshipped at other ports and then sent to Wickford by rail.

This harbor has already been improved by the General Government during 1873–74 to the extent of removng a few obstructing bowlders in the entrance to the harbor and dredging a small amount also at the entrance, thus giving a fair channel of 9 feet depth at low water up to the steamboat wharf. This channel has since remained reasonably permanent.

This harbor was recommended for improvement by General Warren in 1872, and the cost of the needed work was estimated by him at $25,000. (See p. 972, Annual Report of Chief of Engineers, 1873.) This work was never completed, $10,000 only having been appropriated for this purpose. An examination of this harbor with a view to its further improvement and a report thereon were also made in 1893 by Capt. W. H. Bixby, Corps of Engineers. (See Annual Report of the Chief of Engineers for 1893, p. 873, where fuller details may be found.) The present survey is based upon the recommendations of this last examination and report, as amended by the indorsements of the Division Engineer, Chief of Engineers, and Secretary of War.

Plan of improvement.—The inclosed map* shows the results of the recent survey, including the location of the obstructing rocks which it is now proposed to remove, and of the proposed channel. It is proposed to remove bowlders marked A, B, C, D, E, and F at the harbor entrance and in the channel by blasting if necessary, and to dredge the channel 60 feet wide and 9 feet deep with enlargements at the bends up to the highway bridge. The bowlders at A, B, C, D, and E need removal to a depth of at least that of the surrounding bottom after dredging, and the one at F (to be safe at extreme low water and during the high waves of stormy weather) to a depth of at least 12.5 feet at low water.

This seems to be all the improvement that is most urgently needed at present and all that seems now necessary to meet the demands of commerce for some years to come. The previous work of dredging in this harbor and recent borings made for the purpose indicate that the proposed work of channel excavation will be very easy, nothing but soft mud and some fine sand being found, with occasional small round bowlders.

Cost.—This proposed improvement will require the dredging of about 14,000 cubic yards of mud and sand, with occasional small bowlders, which may cost as much as 30 cents per cubic yard, and the excavation also of about 100 cubic yards of bowlders, which will altogether probably cost as much as $1,000.

14,000 cubic yards dredging, at 30 cents	$4,200
100 cubic yards rock excavation, at $10	1,000
	5,200
Superintendence and contingencies about 20 per cent	1,100
Total	6,300

The above estimate is made on the supposition that work will be carried on as fast as advantageous and economical to the Government,

*Not printed.

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thus requiring that the whole of the above amount be allotted in one appropriation. A smaller appropriation will naturally increase the ultimate cost of work.

Very respectfully, your obedient servant,

WM. W. HARTS,
First Lieut., Corps of Engineers.

Brig. Gen. WM. P. CRAIGHILL,
Chief of Engineers, U. S. A.

(Through Col. John M. Wilson, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
Washington, September 7, 1895.

Respectfully forwarded to the Chief of Engineers, concurring in the views and recommendations of the local engineer.

JOHN M. WILSON,
Colonel, Corps of Engineers, Division Engineer,
Northeast Division.

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APPENDIX D.

IMPROVEMENT OF CONNECTICUT RIVER, MASSACHUSETTS AND CONNECTICUT, OF RIVERS AND HARBORS ON LONG ISLAND SOUND, CONNECTICUT AND NEW YORK, AND ON SOUTHERN SHORE OF LONG ISLAND, NEW YORK.

REPORT OF COL. HENRY M. ROBERT, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1895, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Mystic River, Connecticut.
2. Thames River, Connecticut.
3. Connecticut River, Massachusetts and Connecticut.
4. Harbor of refuge at Duck Island Harbor, Connecticut.
5. New Haven Harbor, Connecticut.
6. Breakwaters at New Haven, Connecticut.
7. Housatonic River, Connecticut.
8. Bridgeport Harbor, Connecticut.
9. Black Rock Harbor, Connecticut.
10. Saugatuck River, Connecticut.
11. Norwalk Harbor, Connecticut.
12. Wilsons Point Harbor, Connecticut.
13. Five Mile River Harbor, Connecticut.
14. Stamford Harbor, Connecticut.
15. Harbor at Cos Cob and Mianus River, Connecticut.
16. Port Chester Harbor, New York.
17. Larchmont Harbor, New York.
18. East Chester Creek, New York.
19. Greenport Harbor, New York.
20. Port Jefferson Harbor, New York.
21. Huntington Harbor, New York.
22. Glen Cove Harbor, New York.
23. Flushing Bay, New York.
24. Patchogue River, New York.
25. Browns Creek, Sayville, N. Y.
26. Removing sunken vessels or craft obstructing or endangering navigation.

EXAMINATIONS AND SURVEY.

27. Harbor of West Haven and West River, Connecticut.
28. Black Rock Harbor, Connecticut.
29. Greenwich Harbor, Connecticut.
30. Byram Harbor, Connecticut.
31. Port Chester Harbor, New York.
32. Milton Harbor, New York.
33. Echo Bay and New Rochelle Harbor, New York.
34. Greenport Harbor, New York.
35. Cold Spring Harbor, New York.
36. Hempstead Harbor, New York.
37. Woodsburg Channel, Hempstead Bay, New York.
38. Cos Cob Harbor and Mianus River, Connecticut.

HARBOR LINES.

39. New Haven Harbor, Connecticut.
40. Milford Harbor, Connecticut.

ENGINEER OFFICE, UNITED STATES ARMY,
New York City, July 9, 1895.

GENERAL: I have the honor to transmit herewith the annual reports upon works of river and harbor improvement under my charge for the fiscal year ending June 30, 1895.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Colonel, Corps of Engineers.

Brig. Gen. WM. P. CRAIGHILL,
Chief of Engineers, U. S. A.

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D 1.

IMPROVEMENT OF MYSTIC RIVER, CONNECTICUT.

Mystic River is a narrow tidal stream in the eastern part of the State of Connecticut, about 7 miles west from the boundary of the State of Rhode Island. The navigable part of the river extends in a general north-northeasterly direction for nearly 4 miles from Fishers Island Sound, past the villages of Noank, West Mystic, and Mystic, above which places it receives the discharge of several small fresh-water streams. The village of Mystic lies on both the east and west banks of the river, about 3 miles above Fishers Island Sound. At this point the river is crossed by a highway bridge with a draw. Nearly a half mile farther down is the drawbridge of the New York, Providence and Boston Railroad, and about 1½ miles still farther the village of Noank lies upon the west bank. West Mystic is a small settlement and railroad station a short distance back from the west bank of the river and between Mystic and Noank. The population of Mystic and West Mystic together is about 4,000; that of Noank about 2,000.

Directly opposite the mouth of the river lie Mystic or Ram Island and Ram Island Shoal, which cause the channel to divide and branch off sharply to the northeast and southwest. The northeast channel is 18 feet or more in depth and of sufficient width, but crooked; it is the one used by large vessels. The southwest channel opens out into a broad flat, with about 12 feet available depth.

The river channel up to within about a half mile below the highway bridge had a natural low-water depth of 15 feet or more; its width, from 80 to 300 feet, was sufficient, but there were several bends in its course which made it somewhat difficult of navigation. The mean rise of tide in Mystic River is about 2½ feet.

PROJECT OF IMPROVEMENT.

Under act of Congress of August 11, 1888, a preliminary examination of Mystic River was made. In the report on this examination, dated October 26, 1888, and printed in the Annual Report of the Chief of Engineers for 1889, Part I, page 746, a project for improvement was submitted, which consisted in dredging to make the channel 15 feet deep at mean low water and 100 feet wide and to reduce 5 bends in the channel. The estimate of cost, based upon the U. S. Coast Survey chart of 1882, was as follows:

160,000 cubic yards, at 16 cents	$25,600
Supervision and contingencies, say	4,400
Total	30,000

The beginning of work under this project was approved by the Secretary of War November 1, 1890, after the first appropriation for improving the river had been made. Up to July 1, 1894, 118,034 cubic yards of sand and mud had been dredged and the channel had been completed from the highway bridge at Mystic down to and including the second bend, being 15 feet deep at mean low water and 100 feet wide, with greater width at the bends. At the third and fourth bends, opposite Sixpenny Island, no work had been done. At the fifth or lowest bend the channel had been widened from 25 to 100 feet. A rock ledge was encountered in this bend which made a slight change in the layout of the work necessary.

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A sketch of Mystic River was printed in the Annual Report of the Chief of Engineers for 1893, page 898.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

By act of Congress of August 17, 1894, $3,500 was appropriated for continuing this improvement, and after duly advertising for proposals a contract, dated November 27, 1894, was entered into with the Hartford Dredging Company to excavate and remove about 22,000 cubic yards of material from the lower bend, opposite the Noank shipyards, at the rate of 13.7 cents per cubic yard. Dredging was begun March 21, 1895, and completed April 19, 1895, removing 21,600 cubic yards of sandy mud from the east side of the channel opposite the Noank shipyards and above the ledge rock, widening the channel 70 feet at the middle of the bend, making a depth of 15 feet at mean low water where the previous depths ranged from 6 to 15 feet.

PRESENT CONDITION OF IMPROVEMENT.

The channel is completed as designed from the highway bridge at Mystic down to and including the second bend, being 15 feet deep at mean low water and 100 feet wide, with greater width, up to 300 feet, at the bends. At the third and fourth bends, opposite Sixpenny Island, no work has yet been done, and the 15-foot channel is from 125 to 300 feet wide. At the fifth or lowest bend the channel has been widened, and is now from 150 to 250 feet wide. The ledge rock occurs at the sharpest part of the lowest bend and in the northeast side of the channel, and has a least depth (observed) of 8.8 feet. It covers an area of about 40 by 60 feet, and its removal is estimated to cost about $8,000. The present width of the 15-foot channel at this point is 160 feet, and the rock has been marked by piles.

PROPOSED OPERATIONS.

Future appropriations will be applied to widening and reducing the bends in the channel and to maintaining the depths already made.

In the present condition of business upon the river it will probably be found expedient to apply the remainder of the original estimate to further widening of the lowest bend, rather than to reducing the third and fourth bends opposite Sixpenny Island. These bends have now a minimum width of 125 feet, with 15 feet depth, and no serious difficulty should be met with in that part of the channel. The most generally useful work remaining in this river would be either the removal of the ledge rock opposite Noank or the further widening of the channel near it.

The average annual cost of maintenance of channels in Mystic River has been estimated at $2,000.

Appropriations for the improvement of Mystic River, Connecticut, have been made as follows:

Application.	Date.	Amount.
Dredging above and just below railroad bridge and at the mouth of the river.	Sept. 19, 1890	$10,000
Dredging below railroad bridge	July 13, 1892	10,000
Dredging opposite Noank	Aug. 17, 1894	3,500
Total		23,500

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Mystic River is in the New London collection district, of which New London is the port of entry. The nearest work of defense is Fort Griswold, New London Harbor, about 6 miles west. There is a light-house on Morgan Point, on the west side of the river, at its mouth.

Money statement.

July 1, 1894, balance unexpended	$270.39
Amount appropriated by act of August 17, 1894	3,500.00
	3,770.39
June 30, 1895, amount expended during fiscal year	3,598.40
July 1, 1895, balance unexpended	171.99
Amount (estimated) required for completion of existing project	6,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	6,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

*Abstract of proposals for dredging in Mystic River, Connecticut, * * * opened by Col. H. M. Robert, Corps of Engineers, at New York City, October 16, 1894.*

[Amount available for work, $3,000.]

No.	Name and address of bidder.	Price per cubic yard.	Cubic yards based on price bid.
		Cents	
3	Charles and H. E. Du Bois, 119 South street, New York	16	18,750
4	J. H. Fenner, 380 Communipaw avenue, Jersey City	14	21,426—
6	Alonzo J. Beardsley, Bridgeport, Conn	15	20,000
7	Alonzo E. Smith, Islip, N. Y	18	16,667—
8	Elijah Brainard, 24 State street, New York	17	17,647—
9	The Hartford Dredging Co., Hartford, Conn	* 13.7	21,898—
10	Newburg Dredging Co., Newburg, N. Y	28	10,714—

* Lowest bid; recommended.

Entered into contract November 17, 1894. Contract completed April 19, 1895, 21,600 cubic yards of material having been removed.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1894.

These have been asked for, but not yet received. The last statement received was for 1891, when 31,998 tons was reported.

D 2.

IMPROVEMENT OF THAMES RIVER, CONNECTICUT.

This river is formed by the confluence of the Yantic and Shetucket rivers at Norwich, Conn., and extends southward as a tidal stream 15 miles to Long Island Sound. For 11 miles above its mouth the natural channel is from 13 to 80 feet deep, averaging over 30 feet for the first 4 miles. For 3 miles below Norwich the available depth in 1829 was but 6 feet at mean low water where now there is 11 feet. Histories of the improvements of this river near Norwich, Conn., may be found in the Annual Report of the Chief of Engineers for 1873, page 981, and in that for 1879, Part I, page 331.

Shaws Cove, New London Harbor, is a cove on the west side of Thames River, about 2 miles above its mouth, and constitutes the southern water front of the business portion of the city of New London.

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It is separated from the river by the embankment and trestle of the Shore Line Division of the New York, New Haven and Hartford Railroad, having a draw of 55 feet width. The natural depth in Shaws Cove was from 2½ to 8 feet at mean low water in a narrow and crooked channel bordered by flats.

The mean rise of tide in the Thames River near Norwich is about 3.1 feet; at New London it is 2.5 feet.

PROJECTS FOR IMPROVEMENT.

Prior to 1830 various attempts had been made by private parties and corporations to deepen the channel of this river near Norwich. The first ones were by excavation only, but subsequently stone piers were constructed perpendicular to the channel at shoal spots.

By act of March 2, 1829, Congress appropriated $150 "for making a survey of the river Thames with a view to improve the navigation of the same, and the cost of such improvement."

The survey was made in 1829 by Capt. Hartman Bache, Corps of Engineers. At that time there were four old piers standing. In his report upon the survey, dated February 20, 1830, and printed in House of Representatives War Department Doc. No. 125, Twenty-first Congress, first session, Captain Bache submitted a project for making a channel 60 feet wide, to be either 12 or 14 feet deep at high water (9 or 11 feet at low water) by excavation, by rebuilding one of the existing piers, by adding wings to the other three, extending up and down stream, and converting them into T-walls, and by building ten new piers, extending downstream in curves. The piers were to be built of riprap, 3 feet wide on top, with side slopes of 45°; they were to be built to heights of from 1½ to 3½ feet above highest tide, those farthest up the stream being the highest. The piers were estimated to require 43,436 cubic yards of riprap, and the excavation was placed at 27,895 cubic yards for the 12-foot channel, or 69,251 cubic yards for the 14-foot channel. The cost of the whole work was estimated at $72,650.

The project was adopted, and under appropriations of 1836, 1837, and 1838, $40,000 in all, the piers were built nearly as designed, with the exception of two of the new piers and one wing wall which were not constructed; considerable dredging was done, but no complete records of amount appear to have been kept.

Work was stopped in 1839 by exhaustion of appropriations.

In 1866 a petition of citizens of Norwich, asking for an appropriation for removing obstructions in the river Thames, was referred to the Chief of Engineers and returned by him to the Secretary of War with a report describing the work done upon the river, recommending no further work upon the piers until their efficiency could be investigated satisfactorily, and stating:

> In conclusion, it is considered that, should the sum of $8,000 be appropriated for the improvement of this river to be applied during the next fiscal year, all will be accomplished that can be justifiably undertaken until a commission decides upon other efficacious methods or systems of improvement.

June 23, 1866, an appropriation of $10,000 was made for improving the river, under which a survey was made and a project for dredging to obtain 11 feet at low water (14 feet at high water) was adopted.

Under this and succeeding appropriations up to 1878 this channel was dredged, and, as far as possible, maintained with a width of 100 feet. March 3, 1879, $12,000 was appropriated "for the improvement of Thames River to secure a 14-foot channel," and in accordance there-

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with the project was modified to provide for a channel of that depth at low water.

In 1882, upon the recommendation of Major Barlow, approved by the Board of Engineers, the project was further modified by providing for the construction of five dikes or training walls along the outer sides of the channel curves, with the addition of low walls on the inner side should they be found necessary, the width of the waterway between them increasing from 300 feet (about the full width of the river) at Thamesville, 1 mile below Norwich, to 480 feet at the lower dike.

The object of the training walls was to utilize the action of the tide to keep the channel open. They were to be built up to high-water level, and to have an aggregate length of 13,800 feet. In the same year the projected width of the channel was increased to 200 feet. The improvement was designed to extend over the first 3½ miles below Norwich, and the estimated cost was—

For the five dikes or training walls	$82,800
For dredging 200 feet wide and 14 feet deep	125,280
Total	208,080

Under several appropriations up to 1888 work was carried on under this project without modification.

In May, 1888, in response to a letter from the Hon. Charles Russell, M. C., to the Secretary of War, asking the "approximate cost of completing the 16-foot deep channel to Allyn Point and the 14-foot deep channel to Norwich," estimates for the same were submitted as follows:

For securing, by dredging, a 16-foot channel up to Allyn Point	$24,000
For securing, by dredging, a 14-foot channel from Allyn Point to the end of the existing improvement	16,200

By act of Congress of August 11, 1888, an appropriation of $50,000 was made for continuing the improvement of Thames River, with a clause authorizing its expenditure "at any point between Norwich and New London." The project was therefore extended to include the above-described work, and the estimate for completion was increased accordingly by $40,000, making it $95,000 in 1889.

By act of Congress approved September 19, 1890, an examination of Shaws Cove, New London Harbor, was ordered, which was made in the same year, and the report upon which, dated December 4, 1890, was printed in House Ex. Doc. No. 73, Fifty-first Congress, second session, and also in the Annual Report of the Chief Engineers for 1891, page 833 et seq.

This report stated the desired improvement, which consisted in making a channel 100 feet wide and 12 feet deep at mean low water, extending from the drawbridge along the north and west sides of the cove, a total length of about 2,000 feet, and the anchorage basin in the bend of the channel of the same depth and about 400 by 800 feet.

The estimated cost was—

Dredging the channel, 90,000 cubic yards, at 18 cents	$16,200
Dredging the anchorage basin, 140,000 cubic yards, at 18 cents	25,200
Contingencies, etc	6,600
Total	48,000.00

The river and harbor act approved July 13, 1892, appropriated $30,000 for improvement of Thames River, Connecticut, with proviso that $10,000 of this sum might, in the discretion of the Secretary of War, be applied to improving that part of New London Harbor known as Shaws Cove. The expenditure of $10,000 for this work was approved

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by the Secretary of War July 23, 1892, in order to carry out part of the above plan of improvement. The establishment of harbor lines in Shaws Cove by the Secretary of War, January 26, 1893, necessitated a change in the dimensions of the anchorage basin, without however any material change in its available area (7½ acres) or in its estimated cost.

The existing project for this improvement is therefore the project of 1882 with two extensions, and it now consists in making and maintaining by dredging and a system of training walls a channel 200 feet wide from New London to Norwich, having 16 feet depth at mean low water up to Allyn Point (about 5 miles below Norwich), and 14 feet depth from Allyn Point to Norwich, together with dredging to make and maintain a channel in Shaws Cove, New London, 100 feet wide and 12 feet deep, and an anchorage basin near the bend of the channel of the same depth and of about 7½ acres area. The estimate for completion, $208,080, in 1882 is to be increased by the estimates for the added work, $88,000, and to be reduced by the $20,000 available in 1882, and $195,000 since appropriated, making the present estimate for completion $81,100.

From the beginning of work under this project to July 1, 1894, 464,573 cubic yards of sand, etc., had been dredged from the channel above Allyn Point, 84,890 cubic yards of sand and mud from the 16-foot channels at and below Allyn Point, and 52,120 cubic yards of sand and mud from Shaws Cove. The three dikes farthest downstream had been built, and a fourth one to about three-quarters its contemplated length. The river channel had been made the full depth and width up to Allyn Point. Above Allyn Point the 14-foot channel had been extended to 1½ miles below Norwich, with 100 feet width or over, and thence to Norwich it had been reported made 12 feet deep. In Shaws Cove the channel along the north and west sides of the cove had been made 60 feet wide, and the bend was dredged to 120 feet additional width as part of the projected anchorage ground, all with depth of 12 feet at mean low water.

The last sketches of this improvement printed in the Annual Report of the Chief of Engineers were:

Thames River near Norwich, 1884, page 628.
Shaws Cove, New London, 1893, page 904.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

During the year contracts for dredging have been entered into to widen and deepen the channel near Norwich and to enlarge the anchorage basin in Shaws Cove. Work under these contracts has not yet been begun.

PRESENT CONDITION OF IMPROVEMENT.

Of the five dikes or training walls provided for in the project the four farthest downstream have been built at cost as follows:

	Date of completion.	Length.	Riprap, exclusive of repairs.	Cost, exclusive of supervision.
		Feet.	*Tons.*	
Mohegan, 3⅛ miles below Norwich	1883	2,988	(*)	$23,686.00
Trading Cove, 2½ miles below Norwich	1882	2,370	17,207	21,113.05
Long Rock, 2 miles below Norwich	1885	2,800	11,945	12,781.15
Rolling Mill, 1⅛ miles below Norwich	1887	3,093	18,521	18,772.58

* Pile dike.

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The Rolling Mill Dike, originally designed to be 4,350 feet long, is now 3,093 feet long, with a gap of 390 feet at the "sand pier," and extends northward nearly to the Lower Rolling Mill embankment.

The project contemplated extending it about 600 feet north of the embankment, but since its adoption the Lower Rolling Mill Company has dredged a channel toward shore on the north side of their embankment, which is now used as a landing. It would be necessary to leave an opening for this channel, and probably it will be found expedient not to extend the dike above the embankment.

The upper dike, one-half mile below Norwich, has not been begun.

The low-water depth in the channel from New London to Allyn Point is not less than 16 feet, with width of 200 feet or over; from Allyn Point to the upper end of Walden Island Reach the depth is practically 14 feet and the width not less than 175 feet; above the latter point the 14-foot depth with 100 feet width extends to the "Sand Pier," about 1½ miles below Norwich. For the upper 1½ miles of the river the available depth is 12 feet at mean low water.

The channel in Shaws Cove is 60 feet wide and 12 feet deep at mean low water, with 120 feet additional width at the bend of the channel. No work was done there during the past fiscal year.

PROPOSED OPERATIONS.

Future appropriations will be applied to completing the dikes, if necessary, and to making and maintaining a channel 200 feet wide, to be 16 feet deep at mean low water up to Allyn Point, and thence to Norwich to be 14 feet deep, and to completing the channel and anchorage basin in Shaws Cove, as provided in the approved project.

Appropriations for the improvement of Thames River have been made as follows:

Application.	Date.	Amount.
Removal of obstructions placed during the war of 1812	Mar. 3, 1821	$150
Survey	Mar. 2, 1829	150
Piers and dredging	July 4, 1836	10,000
Do	Mar. 3, 1837	20,000
Do	July 7, 1838	10,000
Dredging and survey	June 23, 1866	10,000
Dredging	Mar. 3, 1867	72,000
Do	Mar. 3, 1871	15,000
Do	June 10, 1872	10,000
Do	June 18, 1878	10,000
Do	Mar. 3, 1879	12,000
Do	June 14, 1880	22,500
Dredging and training walls	Mar. 3, 1881	30,000
Training walls	Aug. 2, 1882	*35,000
Do	July 5, 1884	*25,000
Training walls and dredging	Aug. 5, 1886	*22,500
Repair of training walls and dredging	Aug. 11, 1888	*50,000
Dredging	Sept. 19, 1890	*20,000
Do	July 13, 1892	*†30,000
Do	Aug. 17, 1894	*†12,500
Total		416,800

* Appropriated for present project. These, with $20,000 from previous appropriations (see Annual Report for 1882, Part I, p. 603), make a total of $215,000 for present project.
† $15,000 of which was applied to Shaws Cove, New London Harbor.

The Thames River is in the collection district of New London. The nearest lighthouses are at the mouth of the river, on the west shore. Forts Trumbull and Griswold overlook the mouth of the river from either shore.

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Money statement.

July 1, 1894, balance unexpended	$2,961.04
Amount appropriated by act of August 17, 1894	12,500.00
	15,461.04
June 30, 1895, amount expended during fiscal year	38.63
July 1, 1895, balance unexpended	15,422.41
July 1, 1895, amount covered by uncompleted contracts	10,900.00
July 1, 1895, balance available	4,522.41
Amount (estimated) required for completion of existing project	81,100.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

Abstract of proposals for dredging in Thames River, at Shaws Cove, Connecticut, received in response to public advertisement dated November 22, 1894, and opened December 4, 1894, by Lieut. Col. Henry M. Robert, Corps of Engineers.

[Amount available, about $4,500.]

No.	Name and address of bidder.	Price per cubic yard, scow measure.	Number of cubic yards based on price bid
		Cents.	
1	J. H. Fenner, Jersey City, N. J.*	9	50,000
2	The Hartford Dredging Co., Hartford, Conn	10½	43,902
3	Elijah Brainard, New York City	9⅝	48,000
4	Simon C. Fraser, New London, Conn	12	37,500
5	Alonzo E. Smith, Islip, N. Y	13	34,815

* Lowest bid; accepted; entered into contract December 20, 1894; work not begun.

*Abstract of proposals for dredging in Thames River, near Norwich, Conn., * * * received in response to public notice of ten days, dated March 12, 1895, and opened April 8, 1895, by Col. Henry M. Robert, Corps of Engineers.*

[Amount available, $6,500.]

No.	Name and address of bidder.	Price per cubic yard, scow measure.
		Cents.
2	John H. Fenner, Jersey City, N. J.*	16
4	F. H. Brainard, 24 State street, New York	17.5
6	Newburg Dredging Co., Newburg, N. Y	20
7	William E. Kingston, 24 West Swan street, Buffalo, N. Y	22

* Lowest bid; accepted; entered into contract April 17, 1895; work not yet begun.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1894.

AT NORWICH.

[By courtesy of M. M. Whittemore, treasurer Norwich and New York Transportation Company.]

Arrivals and departures of vessels.

Kind of vessels.	Number of round trips.	Aggregate tonnage of all trips.
Steamers	682	90,406
Sailing vessels	211	275,470
Barges	324	.....
Total	1,217	365,876

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The amount of freight received and shipped by water during 1894 can not be ascertained, but it probably would not vary much from that during 1893, when 546,900 tons were reported.

No new lines of transportation have been established since July 1, 1894.

The year 1894 was not considered a fair average year on account of the general business depression.

In addition to the number of round trips reported above a large number of excursion steamers and private yachts came up the river, but no trustworthy estimate of their number can be given.

D 3.

IMPROVEMENT OF CONNECTICUT RIVER, MASSACHUSETTS AND CONNECTICUT.

This river rises in the northern part of New Hampshire, flows in a general southerly course between the States of New Hampshire and Vermont, crosses the States of Massachusetts and Connecticut, and empties into Long Island Sound at Saybrook Point, Connecticut. The length of the entire river is nearly 400 miles, but the only part which can reasonably be considered susceptible of improvement for navigation is the lower section of about 116 miles length. This section is divided naturally into two parts, Hartford, Conn., practically at the head of low-water navigation, being the point of division, and appropriations by Congress have generally specified in which part the money appropriated was to be expended.

The divisions are as follows:

1. Above Hartford, Conn.—Embracing a length of about 66 miles, from Hartford, Conn., to Millers Falls, Mass.

2. Below Hartford, Conn.—Embracing a length of about 50 miles, from Hartford to Long Island Sound.

By the river and harbor act of 1882 an examination or survey of the Connecticut River from Bellows Falls, Vt., to Pittsburg, N. H., was authorized. Bellows Falls is about 105 miles above Hartford and Pittsburg is 180 miles above Bellows Falls. A preliminary examination was made, the report on which, printed in the Annual Report of the Chief of Engineers for 1884, Part I, page 659, recommended no survey and proposed no plan of improvement.

1. ABOVE HARTFORD, CONN.

Millers Falls, Mass., is at the head of possible navigation of the Connecticut River. From this point down to Holyoke, Mass., a distance of about 32 miles, the river is susceptible of improvement, but it can not be used by vessels now on account of a dam and falls at Holyoke, which entirely obstruct navigation. The lockage required to lift boats from the lower to the upper levels at Holyoke is about 60 feet.

From Holyoke, Mass., to Enfield Falls, Conn., a distance of 18 miles, there is a fair channel, 4 to 5 feet deep at low water, which could be made 8 feet deep. Enfield Falls or rapids cover a stretch of river about 5 miles long, having a fall of about 32 feet at low water. The bed is rocky and very uneven and the slope is not uniform, but consists of a succession of long, shallow reaches separated by rapids.

From the foot of Enfield Falls to Hartford, a distance of 11 miles, the river has a broad, sandy bed, with a depth of 2 to 5 feet at low water. Under a charter from the State of Connecticut granted in May,

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1824, the Connecticut River Company constructed a canal with locks around Enfield Falls. The locks are 80 feet long, 18 feet wide, and 4½ feet deep. The canal is chiefly used for water power. The company collects tolls from vessels using it.

Following is a list of places in this part of the river where work has been done by the United States, with distances above the wagon bridge at Hartford:

	Miles.
Barbers Landing	4
Farmington River	5
Strongs Island	6½
Scantic River	7½

PROJECT FOR IMPROVEMENT.

No general project for the improvement of this part of the river is on record as approved and adopted. All the work done has been under special projects for expenditure of the several appropriations. It consisted of dredging at Barbers Landing in 1873 and construction of dikes or wing dams at Scantic River, Strongs Island, and Farmington River in 1871, at Farmington River and Barbers Landing in 1878, and again in 1880 and 1881.

Plans and estimates for a larger canal around Enfield Falls were submitted in 1878 and modified in 1880. (See Annual Report of the Chief of Engineers for 1881, Part I, p. 566.) They proposed a canal on the east bank of the river, extending from above Enfield Falls down to the mouth of Hockanum River, opposite and just below Hartford, as the best means of gaining an available depth of 8 feet from Hartford to and around the falls. The canal levels were to be 10 feet deep at low water and 120 feet wide at the water line; the locks 200 feet long, 55 feet wide, with 8 feet depth over the miter sills at low water. The cost of the work was estimated at $1,332,805. It was considered not advisable to begin construction with a less sum than $450,000.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

No work was done. The available money is insufficient to begin any general plan of improvement in this part of the river.

PRESENT CONDITION OF IMPROVEMENT.

The wing dams are all in fair condition; they are as follows: One at Scantic River, one at Strongs Island, one at the mouth of Farmington River, two nearly opposite the mouth of Farmington River, and two on the east bank, opposite Barbers Landing. The available channel depth from Hartford to Scantic River is about 2 feet at ordinary summer stage of water; this part of the river is navigable for freighting only when in freshets. No work has been done above Scantic River; the depth from there to the foot of Enfield Falls is greater than from there down to Hartford. There is no present navigation above Enfield Falls, the canal being out of repair.

PROPOSED OPERATIONS.

No work in the river above Hartford is contemplated during the ensuing year. Should any injury to the wing dams occur the money available will be sufficient for repairs.

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Appropriations for improving the Connecticut River above Hartford have been made as follows:

Application.	Date.	Amount.
Dams at Scantic River and Strongs Island, Farmington River, and Barbers Landing; repairs of dams; dredging at Barbers Landing; surveys.....	July 11, 1870	$20,000
	Mar. 3, 1871	20,000
	June 10, 1872	25,000
	Mar. 3, 1873	20,000
	June 14, 1880	15,000
Total		100,000

Of these amounts the following balance is as yet unexpended: From the appropriation of June 14, 1880, for "improving Connecticut River between Hartford and Holyoke," $8,940.30.

Money statement.

July 1, 1894, balance unexpended.....	$8,940.30
July 1, 1895, balance unexpended.....	8,940.30

2. BELOW HARTFORD, CONN.

The Connecticut River below Hartford is a large stream, for the first 21 miles flowing in a winding course, mostly through alluvial meadows, which are overflowed at high water, and which consist of a light, sandy soil, easily undermined. For the remaining 29 miles to Long Island Sound, at Saybrook Point, the course is straighter, the banks more permanent, and generally harder. A gauge has been established at Hartford whose zero is the lowest stage that the water is known to have reached from natural causes; closing the gates at the Holyoke Dam in time of drought has caused the water to fall lower.

The usual low-water stage of the river in the summer is about 1 foot on this gauge. Spring freshets ordinarily rise to 20 feet; the highest recorded stage of water is 29 feet.

The average tide at Saybrook is 3½ feet; at Hartford it is 1 foot, though when the water stands above 5 feet on the Hartford gauge the tide there is not perceptible. The low-water slope of the river from Hartford to Saybrook averages 0.0458 foot per mile. The bed of the river through the alluvial meadows within 10 miles of Hartford is constantly changing from the undermining of the banks. It is said that in places it has changed its position a half mile. The bars in this part of the river, after being dredged, form again during freshets and ice jams, so that some of them require being dredged annually, others less frequently. This part of the river was worked upon by corporations and by private parties at various times between 1800 and 1870. Several small stone piers to deepen the channel at shoal places were built in this way. Some of these are covered by new banks, the channel has shifted to the opposite side of others, and others still have been dredged out because they had come to be obstructions. The depth sought by these works was 6 feet at low water.

The following list gives the names of the several places on the river below Hartford, where work has been done by the United States, with their distances by course of channel below the Hartford wagon bridge:

Locality.	Miles.	Locality.	Miles.
Hartford Bar	1½	Sears Shoal	26
Clay Banks Bar	2½	Haddam Island Bar	30
Pratts Ferry or Naubuc Bar	5½	Chester Rock	38
Press Barn Bar	6½	Devils Reef Bar	39½
Glastonbury Bar	9½	Brockway Bar	41
Dividend Bar	12	Calves Island Bar	44½
Pistol Point Bar	15	Saybrook Bar (at mouth)	50
Mouse Island Bar	20½		

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PROJECTS FOR IMPROVEMENT.

By act of July 4, 1836, Congress appropriated $20,000 "for improving the harbor at Saybrook, by removing the bar at the mouth of the Connecticut River." Under this appropriation a survey was made by Capt. W. H. Swift, U. S. Engineer Corps. In his report on this survey, dated January 31, 1837, and printed in House Ex. Doc. No. 252, Twenty-fifth Congress, Captain Swift submitted a project for deepening the west channel over Saybrook Bar, dredging a cut 500 feet wide and 12 feet deep at mean low water, at an estimated cost of $54,380.50. The estimated cost per cubic yard for dredging and dumping was 25 cents. The available depth over the bar before dredging was 7 feet at mean low water. Captain Swift's project was approved and work was begun in May, 1838, under a contract with Randall, Haskell & Holmes, at the rate of 62½ cents per cubic yard, measured in scows. Dredging was continued until the fall of 1840, when the appropriation was exhausted. Twenty-six thousand nine hundred and eighty-four cubic yards of sand and stone had been removed, making a channel 1,500 feet long, 50 feet wide, and from 11 to 12 feet deep. This channel was nearly destroyed by storms and freshets in the following winter and spring. March 1, 1843, $3,471.57 was appropriated to pay a balance due to the contractors.

No further work was done upon the river until 1867.

By act of Congress approved March 2, 1867, a survey of the river was ordered, which was made in the following season, and which embraced the principal bars and obstructions between Hartford and Long Island Sound. With the report on this survey, dated January 11, 1868, and printed on page 754 et seq. of the Annual Report of the Chief of Engineers for 1868, was presented a project for improving this part of the river. It proposed dredging at Hartford, Clay Banks, Pratts Ferry, Glastonbury, and Pistol Point, to make channels 8 feet deep at low water and 100 feet wide; dredging at Saybrook Bar to make a channel 8½ feet deep and 200 feet wide; piling for shore projection at Hartford and Wethersfield, and the removal of Chester Rock at a total estimated cost of $70,000. An estimate of $10,000 for annual maintenance was submitted. All the dredging done up to 1880 was, in accordance with this project, extended to make 9 to 9½ feet depth instead of 8 feet, and also to include Press Barn, Dividend, and Mouse Island bars. The piling at Hartford was built in 1871, and the removal of Chester Rock was begun in the same year, but abandoned by the contractor soon after beginning.

January 22, 1873, a project for building three jetties at Saybrook and for dredging was approved by the Secretary of War. The jetties were to be of a double row of piles, 20 feet apart, filled with stone to a height of 8 feet above low water. The dredging was to be 9 feet deep and 400 feet wide.

The estimated cost was:

Dredging	$17,850
Jetties	318,760
Total	336,610

Before the work on the jetties was begun the plan of construction was modified to one for building them of riprap stone, triangular cross sections rising to a level of highest water, i. e., about 5 feet above mean low water, this plan being much more economical than the previous one.

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The jetties were begun in 1875 and two of them were completed in 1881. The third has not been built and may not be needed. The west jetty has since been extended, and both have been repaired and strengthened.

The river and harbor acts of 1876 and 1882 provided that $2,000 and $5,000 from the Connecticut River appropriations should be applied to improving the Salmon River, a small tributary on the east side of the Connecticut River, about 32 miles below Hartford. These sums were expended in making a channel 7 feet deep to the village of Moodus.

In 1880 a project was adopted for permanent works of improvement at six of the worst bars. (See Annual Report of the Chief of Engineers for 1880, Part I, p. 396 et seq.) This project provided for riprap wing dams, mattresses, shore protection, and rectification of the banks at the following places, viz:

Locality.	Amount.	Locality.	Amount.
Hartford Bar	$33,464	Glastonbury Bar	$114,922
Clay Banks Bar	69,116	Dividend Bar	7,110
Pratts Ferry or Naubuc Bar	64,735		
Press Barn Bar	41,140	Total	330,487

With dredging to make and maintain a permanent channel. The project did not provide for extension and repair of the Saybrook jetties, nor did the estimates include any amount for annual dredging to maintain channels, nor for dredging between the jetties at Saybrook, nor for any improvement whatever below Middletown, where considerable dredging has been required. All of these have consumed a large part of the appropriations made since.

Under this project, extended to include other necessary dredging up to the fall of 1887, a training wall of riprap 3,689 feet long had been built at Hartford Bar (instead of the proposed wing dam), and a riprap wing dam 5,300 feet long had been built at Glastonbury Bar, both to a height of 3 feet above low water. Part of the Hartford training wall was subsequently built to 4 feet above low water; the west jetty at Saybrook had been extended to the 16-foot curve, the east jetty to the 12-foot curve, and a channel 130 feet wide and 12 feet deep had been dredged between them, besides maintaining the required depths in this part of the river by annual dredging, at a cost of from $5,000 to $10,000 each year.

In 1887 it had become evident that the proposed plan of permanent improvement would not materially reduce the amount of dredging annually required, and that no effectual substitute could be recommended which would not be very expensive, and in December, 1887, a new project was adopted, under which future operations were to be confined to completing the jetties at the mouth of the river to a height of 5 feet above high water, with a top width of 6 feet, widening the channel between the two jetties to 400 feet, with a depth of 12 feet at mean low water, and annual dredging to maintain the channel from Hartford to Long Island Sound, at an estimated cost as follows:

For completing jetties	$60,000
For dredging between jetties	20,000
Total	80,000
For average annual maintenance of channel from Hartford to Long Island Sound	10,000

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The reasons for this change of project are fully given in a letter printed in the Annual Report of the Chief of Engineers for 1888, Part I, pages 536–538.

In 1889 a modification of this project was adopted which provides for raising the dike at Hartford to a height of 15 feet above low water, at an estimated cost of $50,000, making the total estimate for completion at that time $130,000. The reasons for this modification are given in detail in letters to the Chief of Engineers of October 14 and October 24, 1889, printed in the Annual Report of the Chief of Engineers for 1890, Part I, pages 614, 615.

The existing project for this improvement, therefore, now consists in making a channel from Long Island Sound to Hartford, Conn., to be 400 feet wide and 12 feet deep at mean low water across Saybrook Bar, and thence to Hartford to be 100 feet wide (or as near to that width as practicable) and 9 feet deep at extreme low water, or about 10 feet below ordinary summer level; these channels to be maintained by annual dredging, by completing the two jetties at Saybrook Bar, building a wing dam at Glastonbury Bar (already completed), and by raising the height of the dike or training wall at Hartford Bar, at a total estimated cost of $130,000 for the permanent work and $10,000 per year for the annual dredging. The last is considered the most urgent of these works.

Since the modification of the project approved by the Chief of Engineers, December 22, 1887, up to July 1, 1894, 365,460 cubic yards of material had been dredged from the several bars of the river, all in pursuance of that part of the project relating to annual maintenance of channel from Hartford to Long Island Sound. The amount expended on this work during this time was about $46,000.

Up to July 1, 1894, nothing had been done toward raising the dike at Hartford or toward dredging or enlarging jetties at Saybrook, the available funds at no time having been in excess of what was required for annual maintenance of channels.

Sketches of the Connecticut River from Hartford to Rocky Hill and of Saybrook Bar at the river's mouth were printed in the Annual Report of the Chief of Engineers for 1885, page 636.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

At the beginning of the fiscal year the work of maintaining the river channels by annual dredging was in progress under an agreement with C. C. Goodrich at the rate of 12 cents per cubic yard, approved by the Chief of Engineers July 18, 1892. Work was continued until July 12, 1894, when it was suspended and resumed again August 30; dredging under this agreement was finally completed September 17, 1894. From July 1, 1894, to September 17, 1894, 14,206 cubic yards were dredged.

The river and harbor act of August 17, 1894, appropriated $20,000 for this improvement. This being the estimated amount required for annual dredging for two years, it was decided, with approval of the Chief of Engineers, to so apply it. After duly advertising for proposals, a contract for dredging after the freshets of 1895 was entered into with the Newburg Dredging Company, at the rate of 10½ cents per cubic yard of material measured in the scows. Work under this contract was begun May 14, 1895, and is still in progress, up to June 30, 1895, 46,219 cubic yards of sand having been removed, making channels of 9 feet depth at extreme low water through the worst of the bars left by the spring freshets. The total amount dredged during the fiscal year

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ending June 30, 1895, is 60,425 cubic yards, divided among the several bars as follows:

Localities.	Dates.	Cubic yards.
Glastonbury Bar	July 2–7, 1894	3,378
Press Barn Bar	July 9–10, 1894	1,340
Pistol Point Bar	July 11–12, 1894	683
Glastonbury Bar	Aug. 30–Sept. 17, 1894	8,805
Pistol Point Bar	May 14–18, 1895	5,093
Clay Banks Bar	May 20–June 1, 1895	13,625
Hartford Bar	June 1–18, 1895	16,812
Clay Banks Bar	June 18–19, 1895	1,125
Glastonbury Bar	June 19–29, 1895	9,564

The above dredging was done to a depth of 9 feet at extreme low water (about 9½ feet below mean low water) and the channels were generally made 50 to 65 feet wide, only sufficient for the immediate needs of navigation.

PRESENT CONDITION OF IMPROVEMENT.

The Hartford Dike and Saybrook jetties are in good condition, though not yet completed.

The freshets of last spring were much higher than ordinary, but notwithstanding the general condition of the bars was found to be rather better than expected when the water fell. The required depth is being made upon the bars as fast as possible after the freshets, and dredging is now in progress.

PROPOSED OPERATIONS.

Future appropriations will be applied first to annual dredging to maintain a channel of 9 feet depth at extreme low water, and when sufficient funds are available to completing the dike at Hartford, enlarging the Saybrook jetties, and dredging between them. Since the plan of rating annual dredging as of first importance has been adopted the navigable condition of the river has been much better maintained than ever before. To do this work promptly and effectively it is necessary that about $10,000 should be available for each year, to be expended as soon as practicable after the spring freshets subside.

Enlarging the Hartford Dike is important as a means of reducing the amount of dredging annually required at Hartford Bar, and the widening of the channel at Saybrook and enlarging of the jetties there are designed to afford an easier and safer entrance to the mouth of the river.

The amount estimated for completion of the permanent works in this river, viz, the Hartford Dike, the Saybrook jetties, and the channel between these jetties, was $130,000 in 1890. The appropriations made since then have only been sufficient for maintenance of the river channels by annual dredging, to which they have been applied; and the appropriation made in 1894 is also to be applied to such dredging. Consequently the estimated cost of completion of the project remains unchanged.

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Appropriations for improving the Connecticut River below Hartford have been as follows:

Application.	Date.	Amount.
Dredging at Saybrook Bar	July 4, 1836	$20,000.00
Dredging at Saybrook Bar (the unexpended balance of 1836 reappropriated)	Mar. 3, 1839	
Balance due contractor under previous appropriation	Mar. 1, 1843	3,471.57
Survey	Mar. 2, 1867	3,995 22
Dredging at Pratts Ferry, Pistol Point, Mouse Island, piling at Hartford	July 11, 1870	20,000.00
Dredging at Hartford, Clay Banks, Pier I, Pier J, Pratts Ferry, Glastonbury, Pistol Point, and Chester Rock	Mar. 3, 1871	35,000 00
Dredging at Pratts Ferry, Pistol Point, and Saybrook Jetty	June 10, 1872	40 000.00
Dredging at Hartford, Pratts Ferry, Glastonbury, Saybrook Jetty	Mar. 3, 1873	20,000.00
Dredging at Hartford, Pratts Ferry, Saybrook, Saybrook jetties	June 23, 1874	20,000.00
Dredging at Hartford, Pratts Ferry, Glastonbury, Saybrook jetties	Mar. 3, 1875	20,000.00
Dredging at Hartford, Pratts Ferry, Glastonbury, Saybrook jetties, Salmon River dredging	Aug. 14, 1876	20,000.00
Compensation for previous dredging	1878	4,203.00
Saybrook jetties, Survey from Hartford to Rocky Hill	June 18, 1878	30,000.00
Dredging at Hartford, Press Barn, Glastonbury	Mar. 3, 1879	10,000.00
Dredging at Hartford, Glastonbury, Saybrook jetties	June 14, 1880	10,000.00
Dredging at Hartford, Pratts Ferry, Glastonbury, Glastonbury wing dam, Saybrook jetties	Mar. 3, 1881	30,000.00
Dredging at Hartford, Clay Banks, Pratts Ferry, Press Barn, Glastonbury, Dividend, Pistol Point, and Salmon River, Hartford Dike	Aug. 2, 1882	45,000.00
Dredging at Hartford, Clay Banks, Pratts Ferry, Press Barn, Glastonbury, Dividend, Pistol Point, Mouse Island, and between Saybrook jetties, extending west jetty at Saybrook	July 5, 1884	35,000.00
Compensation for previous dredging	Mar. 3, 1885	4,745.43
Dredging at Hartford, Clay Banks, Naubuc, Press Barn, Glastonbury, Dividend, Pistol Point, and Haddam Island; repairs of Hartford Dike and Saybrook jetties	Aug. 5, 1886	26,250.00
Annual dredging at Hartford, Clay Banks, Press Barn, Glastonbury, Dividend, Brockways	Aug. 12, 1888	10,000.00
Annual dredging at Hartford, Clay Banks Press Barn, Glastonbury, Dividend, Pistol Point, Mouse Island, Haddam Island	Sept. 19, 1890	12,500.00
Annual dredging at Hartford, Clay Banks, Naubuc, Press Barn, Glastonbury, Dividend, Pistol Point, Mouse Island, Sears Shoal, Chester Rock, Devils Reef, Calves Island	July 13, 1892	20,000.00
Annual dredging upon several bars below Hartford, in progress	Aug. 17, 1894	20,000.00
Total		469,165.22

The Connecticut River is in the collection district of Hartford. By course of river the distance from Holyoke, Mass., to Hartford, Conn., is about 34 miles, and from Hartford to Long Island Sound about 50 miles.

There is a light-house on Saybrook Point, on the west shore of the river, at its mouth, and another at the end of the west jetty, besides which there are three small beacon lights and several range lights in the river, which are maintained by the United States.

Fort Trumbull, New London Harbor, Connecticut, about 16 miles east of Saybrook Point, is the nearest work of defense.

Money statement.

July 1, 1894, balance unexpended		$7,806.76
Amount appropriated by act of August 17, 1894		20,000.00
		27,806.76
June 30, 1895, amount expended during fiscal year		5,561.88
July 1, 1895, balance unexpended		22,244.88
July 1, 1895, outstanding liabilities	$5,103.34	
July 1, 1895, amount covered by uncompleted contracts	4,072.05	
		9,175.39
July 1, 1895, balance available		13,069.49
Amount (estimated) required for completion of existing project		130,000.00
Amount (estimated) required for maintenance annually		10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		90,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

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*Abstract of proposals for dredging in Connecticut River, Connecticut, * * * opened by Col. H. M. Robert, Corps of Engineers, at New York City, April 8, 1895.*

[Amount available, $9,000.]

No.	Name and address of bidder.	Price per cubic yard.
		Cents.
1	The Hartford Dredging Co., Hartford, Conn	20½
2	John H. Fenner, 380 Communipaw avenue, Jersey City, N. J	19
6	Newburgh Dredging Co., Newburg, N. Y.*	10¼
7	William E. Kingston, 24 West Swan street, Buffalo, N. Y	18

* Lowest bid; accepted.

Entered into contract April 17, 1895; work now in progress.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1894.

[Through courtesy of Mr. C. C. Goodrich, general manager of the Hartford and New York Transportation Company.]

Arrivals and departures of vessels.

[Draft, 7 to 10 feet; tonnage, 100 to 1,000 tons.]

Kind of vessels.	Number of round trips.
Steamers	360
Sailing vessels	220
Barges	550
Total	1,130

Aggregate tonnage of all trips not ascertained.

Freight received and shipped by water.

Chief articles.	Tons.	Estimated value.
Coal	280,000	$1,050,000
Stone	80,000	400,000
Miscellaneous (not otherwise included)	200,000	36,000,000
Total	560,000	37,450,000

No new lines of transportation have been established since July 1, 1894.

During 1894 one 800-ton barge was built and three 500-ton barges were repaired in the river.

These figures show a decrease in tonnage since 1893 of 90,000 tons. The depression in business which continued through the year 1894 is the reason assigned for this decrease.

D 4.

IMPROVEMENT OF HARBOR OF REFUGE AT DUCK ISLAND HARBOR, CONNECTICUT.

Duck Island Harbor is a bay on the north shore of Long Island Sound, between headlands known as Menunketesuck and Kelseys points, respectively on the east and west sides of the harbor. It is about 7 miles west of the mouth of the Connecticut River and midway between the harbors of New Haven and New London. In this distance of 46

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miles there is no secure harbor of sufficient size and depth to shelter any considerable part of the general commerce of the sound. Duck Island Harbor has a large anchorage area, with depths of 16 feet or more at low tide and with good holding bottom. It is sheltered from the north by the mainland, partly sheltered from the east by Menunketesuck Point, and slightly sheltered from the south by Duck Island, an island about 900 feet long (north and south) by 300 feet wide, situated in the mouth of the harbor, rather more than half a mile west-southwest from Menunketesuck Point.

PROJECT FOR IMPROVEMENT.

Under act of Congress of August 2, 1882, a preliminary examination of this harbor was made by Col. J. W. Barlow, Corps of Engineers, the report on which was printed in the Annual Report of the Chief of Engineers for 1884, Part I, page 684, and in Senate Ex. Doc. No. 50, Forty-eighth Congress, first session. This report outlined two plans for improving the security of the harbor, and suggested that the adoption of a project be deferred for further consideration.

The act of Congress approved August 5, 1886, provided for a "resurvey of Duck Island Harbor, on Long Island Sound, including plans, specifications, and estimates of cost for making the same a harbor of refuge." A preliminary examination, together with the recent Coast Survey charts, afforded all the information necessary without a detailed survey. In the report of this examination, dated November 12, 1886, and printed (with map) in the Annual Report of the Chief of Engineers for 1887, Part I, page 641, the required plans, etc., were presented. They contemplated the construction of three riprap breakwaters, one extending westerly from Duck Island, one northeasterly from the island toward Menunketesuck Point, and the third southwesterly from Menunketesuck Point. These would shelter an area of about 115 acres, with 16 feet depth or more at low tide in case of southeast storms, with a larger area for storms from any other quarter. The harbor would have a broad western entrance, with 17 feet depth, and an eastern entrance between the breakwaters over 25 feet deep and about 750 feet wide. The breakwaters proposed were to be of riprap, 10 feet wide on top, which was to be 10 feet above low water level (about 6 feet above high water), with inside slopes of 1 upon 1 and outsides slopes of 2 upon 3.

The estimated cost of riprap stone was as follows:

Breakwater, westerly from Duck Island, 3,000 feet long	tons..	181,000
Breakwater, northeasterly from Duck Island, 1,750 feet long	do...	79,000
Breakwater, southwesterly from Menunketesuck Point, 1,130 feet long	do...	41,000
Total, 301,000 tons of stone, at $1.40 per ton		$421,400
Contingencies, 10 per cent		42,140
Total		463,540

The beginning of work under this project was approved by the Secretary of War September 27, 1890, after the first appropriation for the harbor had been made, and up to July 1, 1894, 57,474 tons of riprap had been delivered and placed in the breakwater extending westerly from Duck Island, building 1,660 linear feet of work to a height of about 7½ feet above mean low water, with top width of 5 feet. The reduced cross section was adopted as a temporary measure to secure a larger sheltered area at once. The work will require enlarging to make it permanent.

A map showing location and other details of this work was printed in the Annual Report of the Chief of Engineers for 1887, page 644.

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OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

By the act of Congress of August 17, 1894, $30,000 was appropriated for continuing this improvement. After duly advertising for proposals, on November 14, 1894, a contract for extending and enlarging the breakwater west from Duck Island was entered into with Hughes Bros. & Bangs, at the rate of 68 cents per ton of riprap delivered and placed. Work under this contract has not yet begun; the contract expires June 30, 1896.

A small light is maintained at the end of the uncompleted breakwater.

PRESENT CONDITION OF IMPROVEMENT.

The present length of the breakwater extending westerly from Duck Island is 1,660 feet, being rather more than half its projected length. Its present termination is in 16½ feet of water at mean low tide. The first 1,000 feet is from 4 to 5 feet above mean low water, having settled from its original height of 7½ feet; the last 660 feet is now about 8 feet above mean low water.

No work has been done on either of the other projected breakwaters.

PROPOSED OPERATIONS.

With the available funds and under the contract now in force the part of this work which has settled will be rebuilt and the whole work extended about 600 feet.

Future appropriations will be applied to extending the westerly breakwater and to building the other breakwaters as provided in the approved project for this work.

Appropriations for harbor of refuge at Duck Island Harbor, Connecticut, have been made as follows:

Application.	Date.	Amount.
Westerly breakwater (946 feet)	Sept. 19, 1890	$25,000
Westerly breakwater (714 feet)	July 13, 1892	35,000
Westerly breakwater (not yet expended)	Aug. 17, 1894	30,000
Total		90,000

Duck Island Harbor is in the collection district of Hartford.

The nearest light-house is at Saybrook Point, at the mouth of the Connecticut River, about 8 miles eastward. There is a light vessel on Long Sand Shoal, about 5 miles to the southeast.

Fort Trumbull, New London Harbor, 21 miles east, is the nearest work of defense.

Money statement.

July 1, 1894, balance unexpended		$1,640.68
Amount appropriated by act of August 17, 1894		30,000.00
		31,640.68
June 30, 1895, amount expended during fiscal year		1,562.04
July 1, 1895, balance unexpended		30,078.64
July 1, 1895, outstanding liabilities	$22.00	
July 1, 1895, amount covered by uncompleted contracts	25,840.00	
		25,862.00
July 1, 1895, balance available		4,216.64

Amount (estimated) required for completion of existing project 373,540.00
Amount that can be profitably expended in fiscal year ending June 30, 1897 100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

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*Abstract of proposals for breakwater construction at Duck Island Harbor, Connecticut, * * * opened by Lieut. Col. H. M. Robert, Corps of Engineers, at New York City, on October 16, 1894.*

[Amount available, $26,000.]

No.	Name and address of bidder.	Price per ton (2,240 pounds.)	Amount of stone per price bid.
			Tons.
1	Chas. F. Stoll, 204 Bank street, New London, Conn	$1.25	21,138
2	Brown & Fleming, 129 Broad street, New York City	.97	26,804
4	S. & E. S. Belden, Hartford, Conn	.95	27,368
5	John A. Bouker, 110 Wall street, New York City	1.23	21,138
6	Hughes Bros. & Banga, Syracuse, N. Y.	*.68	38,255

* Lowest bid.

Contract entered into November 14, 1894. Work not yet begun.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1894.

No record of the number of vessels passing this harbor of refuge is kept. For general purposes it may be assumed as about two-thirds the number passing the New Haven Breakwater, which is reported as 160,160 for the year 1894.

During the year ending June 30, 1895, a partial but nearly complete record has been kept of the vessels observed at anchor behind Duck Island Breakwater, which is as follows:

Schooners	54	Fleet of barges in tow	1
Sloops	11	Steam barge	1
Yachts	11	Fishing steamer	1
Towboats	2	U. S. Coast Survey steamer	1

D 5.

IMPROVEMENT OF NEW HAVEN HARBOR, CONNECTICUT.

New Haven Harbor is a bay on the North shore of Long Island Sound, extending about 4 miles inland and from 1 to 2 miles wide. The Mill and Quinnipiac rivers empty into the head of the harbor. They are streams of no commercial importance except for tidal navigation at or near their mouths.

The harbor channel is from 400 feet to a mile wide, with mud and sand flats on either side. When the Government began work in this harbor in 1867 the available low-water depth from the city wharves to Cranes Bar, about one-third way down the harbor, was 9 feet; thence to Fort Hale, which is about half way down, it was 16 feet or over. A short distance below Fort Hale was a bar of very soft mud, extending across the harbor, with 13 feet available depth at mean low water.

The entrance to the harbor was partially obstructed by several sunken rocks.

PROJECTS FOR IMPROVEMENT.

Several plans for removal of certain of the rocks at the harbor entrance have been proposed and undertaken but not completed. The removal of the harbor light-house to Southwest Ledge and the completion of the proposed system of breakwaters will obviate the necessity of further work upon these rocks.

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The work of deepening the channel in this harbor has for the most part been done in accordance with plans presented in annual or special reports to the Chief of Engineers, the projects being adopted under subsequent appropriations and not based upon examination or surveys ordered by Congress.

In a letter dated January 20, 1871, printed as House Ex. Doc. No. 95, Forty-first Congress, third session, and also on page 771 of the Annual Report of the Chief of Engineers for 1871, General Warren, U. S. Engineers, states that "the business of New Haven requires that there should be a channel dredged 200 feet wide and to a depth of 14 feet at mean low water up to the wharves," and that this is "in many respects more important to New Haven than the removal of the rocks at the entrance to the harbor." It was estimated to cost $64,815.

March 3, 1871, $40,000 was appropriated for this harbor, and it was expended in the same year in making a channel 13 feet deep, 200 feet wide up to Long Wharf, 350 feet wide at the bend at Long Wharf, and 100 feet wide from there to the steamboat wharf.

In a letter of December 23, 1871, printed in House Ex. Doc. No. 137, Forty-second Congress, first session, General Warren submitted an estimate of $26,250 for dredging 16 feet deep and 200 feet wide across Fort Hale Bar, adding that there was some doubt as to the permanence of such a channel. June 10, 1872, $15,000 was appropriated for the removal of rocks and $20,000 for harbor improvement. The former amount was expended upon Luddington Rock; the latter, with part of an appropriation of $25,000 made March 3, 1873, was expended in dredging on Fort Hale Bar, and at the close of the season of 1873 the channel had been made 16 feet deep and 200 feet wide as proposed. It soon filled to nearly its former condition. The 13-foot channel above Long Wharf was widened to 110 feet in the same year.

In the Annual Report for 1873, General Warren says:

> It is thought that no improvement here, beyond what can be accomplished with the funds now available, is called for on the part of the United States, and no further appropriation is asked for.

No appropriation for this harbor was made in 1874, and none was recommended in the Annual Report of that year.

January 21, 1875, the House of Representatives, by resolution, asked "for a report from surveys already made in regard to the expediency of widening and deepening the main channel of New Haven Harbor, Connecticut, to a depth not exceeding 20 feet, and also the expediency and estimate of cost of a breakwater." In a report dated January 27, 1875, Colonel Barlow, U. S. Engineers, then in charge, submitted the following estimates in reply to that part of the resolution relating to the channel (see Annual Report of the Chief of Engineers for 1875, Part II, p. 250):

For channel 400 feet wide and 20 feet deep	$416,490
For channel 400 feet wide and 18 feet deep	276,990
For channel 300 feet wide and 20 feet deep	329,925
For channel 300 feet wide and 18 feet deep	208,890

Also, February 8, 1875, in reply to request from the Chief of Engineers, he estimated $10,000 as the cost of widening to 200 feet the 13-foot channel above Long Wharf already 110 feet wide.

In submitting these reports the Chief of Engineers recommended the latter work "as being of immediate importance, and whatever action may be taken upon the project of making a 20-foot channel, this at least should be done." In a subsequent report on the same matter, February 9, 1875, Colonel Barlow presented an estimate of $35,000 for

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widening the channel above Long Wharf to 400 feet. This was transmitted to the House of Representatives by the Secretary of War, February 13, 1875, with favorable indorsement of the Chief of Engineers. The latter plan was carried out under the appropriation of $10,000 made March 3, 1875, with a balance of about $6,000 from previous appropriations, and the 13-foot channel was made 415 feet wide above Long Wharf, the price of work being much lower than had been estimated.

Nothing was appropriated for this harbor in 1876 and 1877.

In the Annual Report for 1877 Colonel Barlow refers to the estimates submitted in his letter of January 27, 1875, and recommends that the channel below Long Wharf be made 400 feet wide and 16 feet deep, its then dimensions (200 feet wide and 13 feet deep) not affording "sufficient space for convenient navigation." The estimated cost was $40,000.

In 1878, under the appropriation of $25,000 made June 14, 1878, the channel was dredged to the length and depth proposed, with width of 300 feet.

In a letter of February 4, 1879, transmitting map of harbor examination made in December, 1878 (letter printed in the Annual Report of the Chief of Engineers for 1879, Part I, p. 336), Colonel Barlow recommends deepening the channel above Long Wharf and widening the channel below to secure 400 feet width, with 16 feet depth, from the steamboat wharf down to Fort Hale; also dredging a channel 500 feet wide and 16 feet deep through Fort Hale Bar. The work above Fort Hale was estimated to cost $65,000; that below, $35,000. The proposed depth and slightly greater width above Fort Hale was obtained by October, 1881, under three successive appropriations of $15,000 each, made in 1879, 1880, and 1881. Nothing had been done on Fort Hale Bar.

In the Annual Report for 1879 a dike at Sandy Point (opposite Fort Hale) was suggested as a means of increasing the depth on Fort Hale Bar, but on account of its expensiveness was not recommended to be undertaken until dredging had been tried again.

In the Annual Report for 1880 (Part I, p. 445) Colonel Barlow renews his recommendation for dredging a channel through Fort Hale Bar 500 feet wide and 16 feet deep.

In the Annual Report for 1881 (Part I, p. 592), after current observations and borings had been made, a dike from Sandy Point was recommended, the length to be determined experimentally as construction progressed, but to be at least 4,400 feet, which length was estimated to cost $60,000.

Under appropriation of $30,000, made August 2, 1882, a plan for this dike was submitted and referred to The Board of Engineers, by whom it was slightly modified and approved October 2, 1882.

The project as approved consisted of a dike connected with Sandy Point by a shore arm about 2,160 feet long, and extending southward as a channel arm about 3,200 feet, the channel arm and part of the shore arm to be built of creosoted piling in double rows, filled in with stone. In 1883 the location of the shore arm was modified upon the request of oyster growers in the vicinity, and in 1886 the method of construction was changed to use riprap instead of creosoted piling, the latter being found more expensive both to construct and to keep in repair.

The appropriations of 1882, 1886, and nearly all of 1888 were expended upon the dike, building the shore arm and more than half of the chan-

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nel arm. The appropriation of 1884 was expended in dredging under a special project for widening the channel above Long Wharf with depths of 8 to 12 feet, and for removing part of the old piers and abutments at Tomlinson's Bridge, which bridge was at that time being rebuilt.

The present project for making a 16-foot channel across the Fort Hale Bar includes the completion of the dike and dredging a channel 400 feet wide and 16 feet deep through the bar. Revised estimates for completion, made in 1887 (see Annual Report of the Chief of Engineers' for 1887, Part I, pp. 599 and 600), placed the cost of completion at that time at $46,000 for the dike and $47,000 for the channel; total $93,000. This is to be reduced by $45,000, since appropriated, making the present estimate for completion $48,000.

Up to July 1, 1894, the shore arm and 2,089 linear feet of the channel arm of the dike had been built. No dredging had been done on Fort Hale Bar since 1873, and the available depth there was about 13 feet at mean low water; above Fort Hale Bar the channel had been made 16 feet deep at mean low water and from 400 to 700 feet wide.

The last sketch of New Haven Harbor in annual reports of the Chief of Engineers was printed in the report for 1889, page 678.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

The act of Congress of August 17, 1894, appropriated $10,000 for continuing this improvement.

After duly advertising, proposals for dredging to deepen the channel over Fort Hale Bar were received October 16, 1894. The lowest offer received, 12 cents per cubic yard, was deemed too high and all the bids were rejected. The work was readvertised and proposals received, under the same conditions on April 8, 1895, and under date of April 17, 1895, a contract was entered into with R. G. & J. S. Packard to do the required dredging at the rate of 9 cents per cubic yard. Work under this contract is about to begin.

PRESENT CONDITION OF IMPROVEMENT.

The available depth over Fort Hale Bar is about 13 feet at mean low water. Above the bar there is a 16-foot channel up to Tomlinson's Bridge, at the head of the harbor, with from 400 to 700 feet width.

Of the Sandy Point Dike the shore arm, 2,140 feet long, and 2,089 feet of the channel arm (including an ice breaker 20 feet long) have been built; 1,294 feet of the inner end of the shore arm is of riprap; the outer part of the shore arm, 846 feet long, and 254 feet of the north end of the channel arm are built of two rows of creosoted piling, 8 feet apart from out to out, and filled in with stone; 1,815 feet of the channel arm south of the pile work is built of riprap, of which the north 273 feet is on a log foundation; the ice breaker at the north end of the channel arm is also of heavy riprap on log foundation. Parts of the dike have settled from 1 to 2 feet.

PROPOSED OPERATIONS.

Under the existing contract the channel through Fort Hale Bar will be made 16 feet deep and about 100 feet wide. Future appropriations will be applied to widening this channel, or, if necessary, to extending the dike. The estimated cost of completing these works is $38,000, to which should be added an estimate of $5,000 annually required for maintaining the channels and for repairs of dike.

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Appropriations for the improvement of New Haven Harbor have been made as follows:

Application.	Date.	Amount.
Removal of Middle Rock, not expended until 1867	Aug. 30, 1852	$6,000
Removal of rocks	July 11, 1870	15,000
Dredging (13 feet) above Fort Hale	Mar. 3, 1871	40,000
Dredging (16 feet) Fort Hale Bar, and removal of rocks	June 10, 1872	35,000
Dredging (16 feet) Fort Hale Bar	Mar. 3, 1873	25,000
Dredging (13 feet) above Long Wharf	Mar. 3 1875	10,000
Dredging (16 feet), Long Wharf to Fort Hale	June 18, 1878	25,000
Dredging (16 feet) above Long Wharf	Mar. 3, 1879	15,000
Do	June 14, 1880	15,000
Dredging (16 feet), Long Wharf to Fort Hale	Mar. 3, 1881	15,000
Sandy Point Dike	Aug. 2, 1882	30,000
Dredging (18, 12, and 8 feet) above Long Wharf	July 5, 1884	10,000
Sandy Point Dike	Aug. 5, 1886	20,000
Do	Aug. 11, 1888	15,000
Dredging	Sept. 19, 1890	15,000
Do	July 13, 1892	15,000
Dredging (Fort Hale Bar)	Aug. 17, 1894	10,000
Total		316,000

New Haven, the port of entry for the collection district of New Haven, is situated at the head of New Haven Harbor, about 3½ miles from Long Island Sound.

There is a light-house on Southwest Ledge, at the mouth of the harbor.

Fort Hale, 2 miles below the city, commands the channel.

Money statement.

July 1, 1894, balance unexpended	$179.11
Amount appropriated by act of August 17, 1894	10,000.00
	10,179.11
June 30, 1895, amount expended during fiscal year	99.38
July 1, 1895, balance unexpended	10,079.73
July 1, 1895, amount covered by uncompleted contracts	9,000.00
July 1, 1895, balance available	1,079.73
Amount (estimated) required for completion of existing project	38,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	38,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

*Abstract of proposals for dredging in New Haven Harbor, Connecticut, * * * opened by Lieut. Col. H. M. Robert, Corps of Engineers, at New York City, October 16, 1894.*

[Amount available for work, $9,000.]

No.	Name and address of bidder.	Price per cubic yard.	Cubic yards based on price bid.
		Cents.	
3	Charles & H. E. Du Bois, 119 South street, New York City	15	60,000
4	J. H. Fenner, 380 Communipaw avenue, Jersey City, N. J	12	75,000
6	Alonzo J. Beardsley, Bridgeport, Conn	15½	58,065
7	Alonzo E. Smith, Islip, N. Y	16	56,250
8	Elijah Brainard, 24 State street, New York	17½	51,429
9	The Hartford Dredging Co., Hartford, Conn	16	56,250

With approval of the Chief of Engineers, dated October 24, 1895, all bids were rejected as being too high.

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Abstract of proposals for dredging in New Haven Harbor, Connecticut, opened by Col. H. M. Robert, Corps of Engineers, at New York City, April 8, 1895.

[Amount available, $9,000.]

No.	Name and address of bidder.	Price per cubic yard
		Cents
2	John H. Fenner, 380 Communipaw avenue, Jersey City, N. J	9½
3	R. G. & J. S. Packard, 130 Pearl street, New York City*	9
4	F. H. Brainard, 24 State street, New York City	14
5	Abraham & Chas. Du Bois, 119 South street, New York City	11

*Contract entered into April 17, 1895. Work not yet begun.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1894.

Foreign.

Value of imports	$369,193
Value of exports	$2,500,000
Revenue receipts	$104,062
Foreign vessels entered, 49; cleared, 32	81
Domestic vessels entered, 743; cleared, 737	1,480

Tonnage of vessels owned at this port.

Steamers	14,498
Sailing vessels	28,076
Barges	18,619
Total	61,193

Arrival and departure of vessels.

[Draft, 6 to 22 feet; tonnage, 100 to 2,500 tons.]

Kind of vessels.	Number of round trips.	Aggregate tonnage of all trips.
Steamers of all kinds	13,300	3,193,000
Sailing vessels	8,640	5,184,000
Barges in tow, scows, etc	7,920	3,168,000
Total	29,860	11,545,000

Coastwise.

Articles.	Tons.	Estimated value.
Coal received and shipped	907,500	$3,630,000
Iron received	150,000	4,500,000
Lumber received, 92,000,000 feet	142,000	2,860,000
Oysters received and shipped	61,600	718,000
Miscellaneous merchandise:		
Received	998,000	115,000,000
Shipped	925,000	138,750,000
Total	3,184,100	265,458,000

The above figures show an increase in tonnage of freight since last year's report of 79,100 tons.

No new lines of transportation have been established since July 1, 1894.

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D 6.

CONSTRUCTION OF BREAKWATERS AT NEW HAVEN, CONNECTICUT

New Haven Harbor is the only natural harbor of any considerable area and depth in Long Island Sound between New London Harbor, 45 miles east, and Huntington Bay, 32 miles southwest. At this point Long Island Sound is at its widest, and the broad, open mouth of the harbor left the anchorage grounds exposed to storms from a southerly quarter, so that vessels driven in by stress of weather were frequently obliged to cross Fort Hale Bar, going from 2 to 4 miles up the harbor, and to anchor in the dredged channel, in order to reach secure shelter.

PROJECT.

December 15, 1874, the harbor commissioners of New Haven addressed a memorial to the Members of Congress from Connecticut, asking that measures be taken "to procure appropriations by Congress for deepening the main ship channel of the harbor to 20 feet and for constructing a breakwater from the light-house (then on Five-Mile Point) to South west Ledge."

The memorial, printed in House Ex. Doc. No. 162, Forty-third Congress, second session, states that the breakwater contemplated would add greatly to the value of the harbor as a harbor of refuge.

January 21, 1875, a resolution was passed by the House of Representatives asking "for a report from surveys already made in regard to the expediency of widening and deepening the main channel of New Haven Harbor, Connecticut, to a depth not exceeding 20 feet, and also the expediency and estimate of expense of a breakwater between the eastern shore of the entrance to said harbor and Southwest Ledge, so called, or such part of said distance as may be found most expedient or necessary for the protection of said harbor." In reply to this resolution a report was made by Col. J. W. Barlow, Corps of Engineers, dated January 27, 1875, printed in House executive document above mentioned, and also in the Annual Report of the Chief of Engineers for 1875, Part II, page 251, suggesting three locations for a breakwater, viz:

1. That indicated in the resolution and terminating at Southwest Ledge.
2. A line running nearly east and west, its middle point resting upon Adams Fall Rock, about one-half mile north of Southwest Ledge.
3. A line 400 yards farther north, running nearly west from Five-Mile Point.

Estimates of cost, ranging from $248,000 to $465,330, were submitted, and with the report were also presented letters and commercial statistics bearing upon the subject.

The question of a westerly breakwater does not appear to have been considered at that time.

This report is referred to by Colonel Barlow in the succeeding Annual Reports for 1876, 1877, and 1878, and in the latter year additional statistics were submitted, but no action was taken until 1879, when an appropriation of $30,000 was made for the "construction of a breakwater at New Haven, Conn."

In August of the same year an examination of part of the mouth of the harbor was made and a map transmitted to the Chief of Engineers, with several projects for breakwaters, which were referred to The Board of Engineers for report.

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The report of the Board, dated November 24, 1879, and printed in the Annual Report of the Chief of Engineers for 1880, Part I, pages 449–452, recommended a breakwater from Southwest Ledge to Quixes Ledge, as contemplated in the resolution of the House of Representatives of January 21, 1875; but as the anchorage ground would still be exposed to southwesterly gales the Board stated as its opinion that a breakwater extending northwest from Luddington Rock would be necessary. Their plan provided for two riprap breakwaters, 12 feet wide on top, rising 6 feet above high water, with exterior slopes of 1 on 3, and interior slopes of 2 on 3, with estimates as follows:

Estimates for breakwater from Light-House Ledge to Quixes Ledge.

Length of construction.....yards..	1,100
Average height of work.....feet..	32
Average cross section.....yards..	299
Cost per cubic yard.....	$2
328,900 cubic yards, at $2.....	$657,800

Estimates for breakwater in vicinity of Luddington Rock.

Length.....yards..	1,400
Average height.....feet..	28
Cross section.....square yards..	233⅓
326,667 cubic yards, at $2.....	$653,334

This plan locates the easterly breakwater so as to lie between Light-House Ledge (or Southwest Ledge) and Quixes Ledge, and the westerly one to extend in a northwest and southeast direction overlying Luddington Rock. The report of the Board was transmitted to the Secretary of War by the Chief of Engineers with the suggestion that the appropriation ($30,000) be applied toward the construction of the easterly breakwater, and was approved by him January 31, 1880. Before work had been begun the details of cross section were modified with the approval of the Chief of Engineers, so that the exterior slope should be 1 on 2 and the interior 1 on 1.

The first load of stone was delivered April 22, 1880, beginning the east breakwater at the end resting upon Southwest Ledge. Under subsequent appropriations it was extended northeasterly and completed to and across Quixes Ledge on February 22, 1890.

The river and harbor act of 1888 provided:

> And the Chief of Engineers may, if deemed necessary, relocate the western breakwater, and the Secretary of War is authorized, in his discretion, to expend any portion of said sum in its commencement.

An examination in reference to this matter was made in the fall of 1888 and the results reported to the Chief of Engineers in a letter dated January 26, 1889, and printed in the Annual Report of the Chief of Engineers for 1889, Part I, page 679. In the Annual Report for 1889 (see Annual Report of the Chief of Engineers for 1889, Part I, p. 678) was presented a modification of the project adapted to the present and prospective requirements of commerce of Long Island Sound. This modification contemplated the relocation of the westerly breakwater by changing its location about 6,000 feet to the southwestward and the construction of a middle breakwater, commencing at a point 1,000 feet N. 54° E. from Luddington Rock, and extending S. 54° W. 5,000 feet, crossing the rock; and also a breakwater about 1,200 feet long, to partly close the space between Quixes Ledge and the east shore.

The cross section of these breakwaters was intended to be the same as the one from Southwest Ledge to Quixes Ledge, viz, 12 feet wide on

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top, the top to be 6 feet above mean high water, with outer slope of 1 upon 2 and inner slope of 1 upon 1. It was estimated that this relocation of the western breakwater including the intermediate breakwater across Luddington Rock, would increase the cost of completion ($941,135 in 1889) by about $750,000, and the construction of the breakwater at the east shore would add about $90,000 more.

By act of Congress approved September 19, 1890, $120,000 was appropriated for "constructing breakwater at New Haven, Conn., in accordance with the plans submitted by the Chief of Engineers in report for 1889, page 678."

The estimated cost of this project from the beginning is therefore ($1,311,134+$750,000+$90,000) $2,151,134.

Up to July 1, 1894, $610,000 had been appropriated for this work and nearly all expended. The breakwater easterly from Southwest Ledge had been completed, and of the breakwater crossing Luddington Rock 3,166 linear feet had been built.

A sketch of New Haven Harbor, showing the locations of breakwaters proposed under the existing projects, was printed in the Annual Report of the Chief of Engineers for 1889, page 678.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

By act of Congress of August 17, 1894, $125,000 was appropriated for this work, and under date of November 14, 1894, a contract was entered into with Messrs. Hughes Bros. & Bangs, of Syracuse, N. Y., for extending the Luddington Rock Breakwater, by delivering and placing about 150,000 tons of riprap granite, at the rate of $0.74 per gross ton. Delivery of stone under this contract was begun December 19, 1894, and continued until May 18, 1895, when it was suspended for the summer months. The amount of stone delivered under this contract up to July 1, 1895, is 51,048 tons, with which the breakwater was extended 675 feet southwestwardly. The contract expires June 30, 1896.

During the year lights have been maintained on this breakwater by the Engineer Department.

PRESENT CONDITION OF WORK.

The east breakwater was completed February 22, 1890; it is 3,450 feet long, extending from the foundation of the light-house on Southwest Ledge northwesterly to and across Quixes Ledge, terminating in a depth of 16 feet of water at the edge of the east entrance channel. It contains 293,777 tons of riprap, and the average cost (supervision, etc., included) has been $102.50 per linear foot. The whole work is in good condition.

The breakwater crossing Luddington Rock is now 3,841 feet long, 500 feet of which lies northeast of the crest of the rock and 3,341 feet southwest. It has all been built to a cross section of 12 feet top width, the top being 6 feet above mean high water, with side slopes of 1 upon 1. As the work settles slight repairs will be needed; the outer slope will also need building out to a slope of 1 upon 2.

Luddington Rock Breakwater now contains 271,102 tons of riprap, and its present southwest end is in a depth of 25 feet at mean low water.

PROPOSED OPERATIONS.

Under the existing contract, the Luddington Rock Breakwater will be extended to about its full projected length, though with scant slope

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on the outer side. Future appropriations will be applied to completing this breakwater and to carrying out the adopted project.

Appropriations for breakwaters at New Haven have been as follows:

Application.	Date.	Amount.
Easterly breakwater	Mar. 3, 1879	$30,000
Do	June 14, 1880	30,000
Do	Mar. 3, 1881	60,000
Do	Aug. 2, 1882	60,000
Do	July 5, 1884	40,000
Do	Aug. 5, 1886	75,000
Completing easterly breakwater	Aug. 11, 1888	75,000
Middle breakwater	Sept. 19, 1890	120,000
Do	July 13, 1892	120,000
Do	Aug. 17, 1894	125,000
Total		735,000

New Haven, the port of entry for the collection district of New Haven, is situated at the head of New Haven Harbor, about 4 miles north of the breakwaters.

There is a light-house on Southwest Ledge, the west terminus of the east breakwater.

Fort Hale, 2 miles north of the breakwater, commands the harbor channel.

Money statement.

July 1, 1894, balance unexpended		$2,731.02
Amount appropriated by act of August 17, 1894		125,000.00
		127,731.02
June 30, 1895, amount expended during fiscal year		36,881.82
July 1, 1895, balance unexpended		90,849.20
July 1, 1895, outstanding liabilities	$5,222.66	
July 1, 1895, amount covered by uncompleted contracts	73,234.48	
		78,457.14
July 1, 1895, balance available		12,392.06
Amount (estimated) required for completion of existing project		1,416,134.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		500,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

*Abstract of proposals for breakwater construction, New Haven Harbor, Connecticut, * * * opened by Lieut. Col. H. M. Robert, Corps of Engineers, at New York City, October 16, 1894.*

[Amount available, $110,000.]

No.	Name and address of bidder.	Price per ton of 2,240 pounds.	Amount of stone per price bid.
			Tons.
2	Brown & Fleming, 129 Broad street, New York City	$1.06	103,774
3	James J. Moran, 5 Court square, Brooklyn, N. Y.	.95	115,789
4	S. & E. S. Belden, Hartford, Conn	.96½	113,695
5	John A. Bouker, 110 Wall street, New York City	*1.06 †1.13	104,762 97,345
6	Hughes Bros. & Bangs, Syracuse, N. Y. ‡	.74	148,649
7	A. M. Newton, New York City	1.06	105,774

* Gneiss. † Granite. ‡ Contract entered into November 14, 1894; not yet completed.

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COMMERCIAL STATISTICS FOR THE CALENDAR YEAR, 1894.

Vessels passing New Haven Breakwater.

Men of war	35
Steamers of all kinds	48,750
Steamships	1,850
Ships, barks, and brigs	1,525
Schooners and sloops of all kinds	60,500
Barges in tow, scows, etc	47,500
Total	160,160

These records are not complete, as some vessels pass unobserved in the night or in thick weather.

The value of this commerce can not be ascertained.

For six months of the fiscal year just closed, during progress of work upon breakwater construction, a record has been kept of all the vessels observed at anchor behind the breakwaters, 41 in all.

D 7.

IMPROVEMENT OF HOUSATONIC RIVER, CONNECTICUT.

The Housatonic is a long, shallow river running southward through Massachusetts and Connecticut, emptying into Long Island Sound just east of Stratford Point, about 15 miles southwest from New Haven. At Derby, 13 miles above its mouth, it receives the discharge of the Naugatuck, a small, rapid river. This point, which has been regarded as the head of navigation, is nearly the head of tide water. About a mile above there is a dam across the Housatonic River, furnishing large water power. For at least 5 miles below Derby the water is always fresh.

The original depth on the worst bars in the river (6 in number) was from 3.5 to 4.5 feet at mean low water; there was also a bar across the river's mouth with about 4 feet low-water depth.

PROJECTS FOR IMPROVEMENT.

In pursuance of a resolution of the House of Representatives dated December 20, 1869, authorizing a survey of the Housatonic River below Derby, which resolution was referred by the Secretary of War to the Chief of Engineers for report as to the "necessity for the survey," an examination of the river from Derby to Long Island Sound was made by Col. D. C. Houston, Corps of Engineers, who reported January 8, 1870, and recommended a detailed survey of all that part of the river, at an estimated cost of $5,000. This report was printed in House Ex. Doc. No. 62, Forty-first Congress, second session,

By act of Congress approved July 11, 1870, a survey of Housatonic River below Derby, Conn., was directed and an allotment of $2,700 was made for a survey "sufficient to determine the prominent obstructions to navigation." In his report on this survey, dated January 23, 1871, and printed in House Ex. Doc. No. 95, Forty-first Congress, third session, and also in the Annual Report of the Chief of Engineers for 1871, page 781, Gen. G. K. Warren, Corps of Engineers, submitted the following estimates for making a channel 7 feet deep at mean low water, to be 200 feet wide over the bar at the mouth of the river, and 150 feet wide in the river, the channel at the river's mouth to be protected on the east side by a breakwater from Milford Beach:

Jetty at Sow and Pigs Reef	$4,000
Removing Drews Rock, 357 cubic yards	2,000
Dredging inside the bar at the mouth	18,486
Dredging on the bar at the mouth	12,000
Construction of breakwater at mouth	368,475

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The breakwater was to be built of riprap up to 1½ feet above mean low water and of dimension stone above. It was to be 6 feet wide on top, rising to 11 feet above low water, and was to extend to the 6-foot curve, an estimated length of 4,200 feet.

March 3, 1871, the first appropriation for improvement of the river was made, and work in accordance with the project was begun. In 1872 the project was modified to admit of a jetty connecting Drews Rock with the west bank, instead of removal of the rock. This was done on the ground of economy, and the jetty was built in 1872. The result was to form a bar below the jetty, which required such frequent dredging that it was found expedient to remove the rock, as originally projected. This was done in 1887–88.

Dredging on the several bars in the river had been done from time to time before 1885, but no work had been done upon the bar at the mouth. The importance of deepening the entrance to the river, then about 4 feet deep, was not overlooked, but it was believed that a dredged channel would have little or no permanency unless protected by a breakwater, and appropriations had not been made in sufficient amount to warrant beginning breakwater construction upon the estimates submitted in 1871. In 1879 Major Barlow proposed to substitute for the originally designed breakwater a riprap structure, such as had been built in other parts of Long Island Sound, and in order to make the estimated cost as low as possible he proposed to try the effect of such a work built up to low-water level only, and about 6,000 feet long, which he estimated to cost $12,000. In 1882 this estimate was raised to $20,250. In 1885 and 1886 certain oyster growers who wished to use the material of this bar for oyster beds offered to dredge a channel without expense to the United States. With approval of the Secretary of War this was done under contract, and in two years 52,888 cubic yards of sand, gravel, and shells were dredged, making an entrance channel 70 feet wide and 9 feet deep. The first severe storm which occurred after the channel was dredged filled it at its outer end and showed practically that dredging there was useless unless the channel could be protected by a sufficient breakwater.

Therefore, in the Annual Report for 1887 (see Annual Report of the Chief of Engineers for 1887, Part I, p. 607), Colonel Houston, U. S. Engineers, then in charge, presented revised estimates for a breakwater, modifying the originally proposed method of construction to one for using riprap only, experience at the harbors of Long Island Sound having shown this construction to be as durable as dimension work and more economical.

At the same time estimates based on recent surveys for dredging necessary to make the channel 7 feet deep, with width 200 feet at the mouth of the river and 100 feet above, were submitted. The latter width was adopted in 1883, because up to that time the originally proposed width of 150 feet had never been obtained.

Following are the estimates for breakwater and for dredging submitted in 1887:

For a breakwater 5,750 feet long, extending from Milford Beach 3,250 feet in a course about south-southeast, thence parallel with and 500 feet from the channel 2,500 feet farther to the 12-foot curve; inside the bend to be built up three feet above mean low water, top width 6 feet, side slopes 1 upon 1; outside the bend to be built up to 6 feet above high water, top width 12 feet, outer slope 1 on 2, and inner slope 1 on 1	$175,000
For dredging at the mouth of the river and at 6 bars in the river, 146,000 cubic yards, at 16 cents, with about 15 per cent added for contingent expenses	27,000
Total	202,000

to which should be added about $4,000 annually required for maintenance of channels.

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January 27, 1888, a letter further explaining the reasons for the new estimate for breakwater was submitted to the Chief of Engineers, and was subsequently printed as Senate Ex. Doc. No. 103, Fiftieth Congress, first session, and also in the Annual Report of the Chief of Engineers for 1888, Part I, page 554.

Construction of the breakwater was begun July, 1889, the shore end being located on Milford Beach, on a tract of land deeded to the United States for that purpose (Annual Report of the Chief of Engineers for 1889, p. 690). In July, 1892, after the breakwater was sufficiently advanced to afford some protection, a channel 7 feet deep was dredged through the outer bar.

At the bend in the river between Stratford and the Sound, where the currents had formed two channels in the river, a small riprap dike was begun in 1893 to cut off the westerly one of these channels.

Up to July 1, 1894, the breakwater at the mouth of the river had been built to a length of 5,025 feet, the 3,250 feet nearest the shore being built to half-tide level and the outer 1,775 feet to 4 feet above high water, with top width of 5 feet. The available depth on the bars in the river was from 4 to 5 feet, and on the outer bar nearly 9 feet.

Sketches of the mouth of the Housatonic River were printed in the Annual Reports of the Chief of Engineers for 1886, page 642, and for 1887, page 608, and a sketch of the whole length of the river below Derby in the report for 1882.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

Under the appropriation of $25,000 made by act of Congress of August 17, 1894, proposals for extending the breakwater at the river's mouth were received and a contract was entered into with S. & E. S. Belden, of Hartford, Conn., for furnishing and placing about 14,000 tons of riprap at the rate of $1.09 per gross ton.

Work under this contract was begun March 27, 1895, and up to the close of the fiscal year 7,197 tons of riprap had been placed, extending the work by about 300 linear feet. The contract is not yet completed.

PRESENT CONDITION OF IMPROVEMENT.

The breakwater is now 5,325 feet long, and contains 49,616 tons of riprap; for 3,250 feet nearest the shore end it is built to about half-tide level; the outer 2,075 feet are built up to 4 feet above mean high water, with top width of 5 feet.

During the past year the channels over the bars in the river have changed little; their available depth is generally from 4 to 5 feet at low tide. The channel on the outer bar, dredged 9 feet deep in the spring of 1893, has shoaled slightly, but is still about 8 feet deep.

PROPOSED OPERATIONS.

Under an existing contract the breakwater will be extended nearly to the projected length. Part of the available funds have been reserved to apply to the extension of the dike below Stratford and to dredging on the several bars should it become imperative.

Future appropriations should be applied to making and maintaining the river channel by dredging, and to completing the breakwater and the dike.

The estimated cost of completing this improvement is $87,000, to which should be added about $4,000 annually required for maintenance of dredged channels and for repairs.

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Appropriations for the Housatonic River have been made as follows:

Application.	Date.	Amount.
Examination	Mar. 2, 1867	$42
Survey	July 11, 1870	2,700
Sow and Pigs Jetty, dredging	Mar. 3, 1871	15,000
Drew Rock Jetty, dredging	June 10, 1872	15,000
Dredging	Mar. 3, 1873	10,000
Do	June 23, 1874	10,000
Do	Mar. 3, 1875	5,000
Do	June 18, 1878	5,000
Do	June 14, 1880	2,000
Do	Mar. 3, 1881	2,000
Removing Drew Rock and Jetty in 1887	Aug. 2, 1882	2,000
Do	July 5, 1884	2,500
Do	Aug. 5, 1886	5,000
Commencing breakwater, dredging	Aug. 11, 1888	35,000
Extending breakwater, dredging	Sept. 19, 1890	35,000
Extending breakwater, dike, and dredging	July 13, 1892	20,000
Do	Aug. 17, 1894	25,000
Total		191,242

The Housatonic River is the boundary between the collection district of New Haven and Fairfield. The nearest work of defense is Fort Hale, New Haven Harbor, about 15 miles east. The nearest light-house is on Stratford Point, at the mouth of the river.

Money statement.

July 1, 1894, balance unexpended		$1,435.00
Amount appropriated by act of August 17, 1894		25,000.00
		26,435.00
June 30, 1895, amount expended during fiscal year		4,273.65
July 1, 1895, balance unexpended		22,161.35
July 1, 1895, outstanding liabilities	$5,382.83	
July 1, 1895, amount covered by uncompleted contracts	7,415.27	
		12,798.10
July 1, 1895, balance available		9,363.25
Amount (estimated) required for completion of existing project		87,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		87,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

*Abstract of proposals for breakwater construction, Housatonic River, Connecticut, * * * opened by Lieut. Col. H. M. Robert, Corps of Engineers, at New York City, October 16, 1894.*

[Amount available, $25,000.]

No.	Name and address of bidder.	Price per ton of 2,240 pounds.	Amount of stone per price bid.
			Tons.
2	Brown & Fleming, 129 Broad street, New York City	$1.14	13,158
4	S. & E. S. Belden, Hartford, Conn	1.09	*13,761
5	John A. Bouker, 110 Wall street, New York City	1.10	13,636

*Lowest bid; accepted. Contract entered into November 30, 1894. Work in progress.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1894.

These were asked for, but have not yet been received. They would probably not vary materially from those given for the year 1893, when the total commerce of the river was reported as 159,830 tons.

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D 8.

IMPROVEMENT OF BRIDGEPORT HARBOR, CONNECTICUT.

This harbor extends nearly 3 miles inland from the north shore of Long Island Sound, its width of about 1 mile at the mouth decreasing to 200 feet between opposite wharves at its upper end. The channel even in the widest part of the harbor is comparatively narrow.

Before the first work by the United States was done at this harbor the depth over the bars at the harbor's mouth was about 5 feet at low water, equivalent to 11.5 feet at high water, and the low-water depth above the bridges was from 2 to 7 feet.

PROJECTS FOR IMPROVEMENT.

In 1833 a petition of the citizens of Bridgeport was presented to Congress asking an appropriation of $10,000 to improve the harbor. This was granted in 1836, and the agent in charge was instructed by the Engineer Department to dredge a channel 8 feet deep, making it 200 feet wide through the outer bar and 100 feet wide through the inner bar, or so much as the appropriation would admit of. The work was done by contract in 1837. The rate was high (understood to be 72.8 cents per cubic yard), and the funds were exhausted when the channel through the outer bar had been made 60 feet wide.

In 1838 Captain Swift, U. S. Engineers, reported that the channel had been sounded and was found to be 12 feet deep, or 4 feet deeper than when left by the dredger.

Nothing further was done until 1852, when a second appropriation of $10,000 was made.

Captain Dutton, U. S. Engineers, found that the channel on the outer bar was then 6 feet deep and 90 feet wide, and on the inner bar but 5 feet deep, and he submitted a project for dredging through both bars to a depth of 8 feet and a width of 200 feet, at a total estimated cost of $32,000. This project was approved by the Secretary of War February 5, 1853, and with the $10,000 then available channels 8 to 13 feet deep were dredged 100 feet wide through the inner bar and 60 feet wide through the outer bar.

By act of Congress approved June 23, 1866, a survey of the harbor was ordered, which was made in that year. The object of the survey was to ascertain "the present state of the harbor and the character and extent of the encroachments upon it by the action of the tides," it being feared that Long Beach, on the east side of the harbor's mouth, was making northwestward by reason of sand drifting along the shore in such a way as to contract and ultimately fill up the channel above the inner bar. Col. D. C. Houston, U. S. Engineers, then in charge, in his report on the survey, dated January 12, 1867, stated that it had been proposed to construct a breakwater extending out from Long Beach to arrest the sand; but the danger feared did not seem imminent, and he recommended a series of observations for the purpose of ascertaining the nature and amount of changes taking place.

In 1867 a survey of the shore line of Long Beach was made.

In 1868 the officer in charge was directed by the Chief of Engineers to make "such resurvey of Bridgeport Harbor, Connecticut, as may be found necessary to ascertain what changes have occurred since the survey of 1866." In the report on this survey it was stated that the

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channel remained the same and that no appropriation was needed until "the channel is found inadequate to the necessities of commerce, and then dredging must be resorted to."

In 1870 a petition of citizens of Bridgeport was presented to Congress asking that an appropriation "be made to remove said sand bar (the outer bar) and to widen and deepen said channel and harbor in order that vessels drawing 12 feet of water may be enabled to enter without being grounded and without the aid of lighters," and a survey or examination of the harbor was ordered.

The work was then in charge of General Warren, U. S. Engineers. He made an examination of the harbor and found it unnecessary to make further surveys. In his report, dated January 12, 1871, General Warren submitted a project for dredging a channel 100 feet wide and 12 feet deep at extreme low water (or 14 feet deep at mean low water), and for building a pier 3,000 feet long, extending out from Long Beach, to be partly of riprap, partly of dolphins. The estimated cost of the project was $124,000. After an appropriation of $20,000 was made, in 1871, work under this project was begun, dredging to depths of 12 and 13 feet at mean low water and substituting a riprap jetty for riprap and dolphins. The jetty was completed as far as deemed necessary in 1873.

In 1875 the dimensions of the projected channel were modified so as to make it 12 feet deep at mean low water and from 200 to 300 feet wide. This was accomplished in 1882.

In 1878, in compliance with the terms of the appropriation act of that year, a channel 100 feet wide and 9 feet deep was dredged from the lower bridge to the horse-railroad bridge, a distance of about 3,000 feet.

After the appropriation of 1882 a project for widening to 600 feet the channel between the Inner Beacon and the Naugatuck Railroad Wharf was adopted to prevent overcrowding the main channel by vessels entering to seek refuge during storms. The estimated cost was $60,000. This is nearly completed, a small area near the Inner Beacon remaining to be dredged.

In November, 1887, a petition was sent to the Secretary of War, signed by the mayor and other citizens of Bridgeport, asking that $10,000 be appropriated for a channel 8½ to 9 feet deep and 100 feet wide above the horse-railroad bridge. This petition, with indorsements and reports estimating $18,000 as the cost of such work, is printed in the Annual Report of the Chief of Engineers for 1889, Part I, pages 697–699.

The appropriation act of 1888 authorized this work, and the project was therefore extended to include it.

March 8, 1889, a petition was addressed to the Secretary of War by the mayor and other citizens of Bridgeport representing the necessity of a breakwater within the harbor of Bridgeport. This petition, with indorsements, is printed in the Annual Report of the Chief of Engineers for 1889, Part I, pages 700–702. The indorsements estimate the cost of a breakwater from the Tongue to the Inner Beacon at about $30,000, and authorize the extension of the project to include this work.

The river and harbor act of 1894 appropriated $10,000 for continuing this improvement and authorized the expenditure of so much of this amount as might be necessary for deepening the channel at the outer bar and for making a new survey of the harbor. Under this authority, and with approval of the Secretary of War, the project was extended

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to provide for a channel 15 feet deep at mean low water and 100 feet wide through the outer bar. No estimate was submitted for an increased width, because the object of the survey was to present before Congress a revised project for the entire improvement of the harbor with estimates of cost.

The project for improving this harbor, as thus extended, consists—

1. In building a breakwater at the east shore of the harbor's mouth and in dredging to make and maintain a channel 12 feet deep at mean low water and 300 feet wide or more from Long Island Sound to the lower bridge; nearly completed. Estimated cost to complete, $17,000.

2. In dredging to make and maintain a channel 9 feet deep and 100 feet wide from the lower bridge to the head of the harbor; partly completed. Estimated cost to complete, $3,000.

3. In building a breakwater from the Tongue to the Inner Beacon; now finished, except for enlarging the cross section. This was originally estimated to cost $30,000. Fifteen thousand dollars has been expended upon it, and it is believed that $5,000 will be sufficient to complete it.

4. In deepening the channel at the outer bar, to make it 15 feet deep at mean low water and 100 feet wide, to be done under the available appropriation.

It is probable that ultimately an extension of the east breakwater will be required in order to prevent the shoaling of the outer bar.

Up to July 1, 1894, a breakwater had been built at Long Beach on the east side of the harbor entrance; the channel from Long Island Sound to the lower bridge had been dredged 12 feet deep and 300 feet wide or over, it being 770 feet wide between the Inner Beacon and the Naugatuck Railroad Wharf. Above the lower bridge the channel had been made 9 feet deep at mean low water, with width of 100 feet to the horse-railroad bridge; thence for a distance of about 2,600 feet (to within 25 feet of the upper landing in the harbor), with width from 90 to 60 feet. The breakwater from the Tongue to the Inner Beacon had been built to its full length, 1,165 feet, with a top width of 5 feet at 3 feet above high water, a cross section adopted in order to cover the whole distance at once and thus prevent scouring on line of work.

Harbor lines for this harbor were established by the Secretary of War July 1, 1893.

The last sketch of Bridgeport Harbor in the Annual Reports of the Chief of Engineers was printed in the Report for 1893, page 940.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

By act of Congress of August 17, 1894, $10,000 was appropriated for continuing this improvement, "of which, in the discretion of the Secretary of War, so much as may be necessary may be used in deepening the channel at the outer bar and in making a new survey of the harbor.'

With the approval of the Secretary of War the appropriation was applied to making a channel through the outer bar, to be 100 feet wide and 15 feet deep at mean low water, and to making the survey of the harbor.

After advertising for proposals a contract was entered into with Alonzo J. Beardsley, under date of October 29, 1894, to dredge and remove from the outer bar about 70,000 cubic yards of material at the rate of 11½ cents per cubic yard. Work under this contract was begun November 10, 1894, was suspended during part of the winter, resumed

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March 25, 1895, and is still in progress. Up to the close of the fiscal year 48,456 cubic yards have been removed and the required channel has been made for a length of about 2,800 feet upon the bar.

The survey provided for in the appropriation act has been made and is now being platted.

PRESENT CONDITION OF IMPROVEMENT.

The channel on the outer bar is 200 feet wide and 11 feet deep at mean low water, with a 15-foot channel 100 feet wide in progress, thence across the inner bar and up to the Inner Beacon the 12-foot channel is about 300 feet wide, thence up to the Naugatuck Railroad Wharf it is 770 feet wide; from that wharf to the lower bridge it has shoaled so that the present depth is from 10 to 11 feet.

The channel from the lower bridge to the horse-railroad bridge, dredged 9 feet deep and 100 feet wide in 1878, retains nearly that depth and width. The 9-foot channel above the horse-railroad bridge is from 60 to 90 feet wide and about 2,600 feet long, extending to within 25 feet of the upper landing.

The breakwater at Long Beach has settled since it was built in 1871-1873; it still serves the purpose for which it was designed and no repairs are now needed.

The project of 1882 for making 600 feet width of channel between the Inner Beacon and the Naugatuck Railroad Wharf was reported completed in 1887. A greater width (770 feet) was obtained in 1893. The Inner Beacon has since been rebuilt, and its location slightly changed, which makes it desirable to cut off a short point outside the new position of that beacon. This was partly done in 1888.

The breakwater from the Tongue to the Inner Beacon has been built to its full projected length, with reduced cross section. It will probably require some enlargement to make it permanent.

PROPOSED OPERATIONS.

Under the existing contract the channel through the outer bar will be completed to 100 feet width and 15 feet depth at mean low water.

The object of the survey authorized by the river and harbor act of 1894 was to have presented before Congress plans and estimates for a revised project for improvement of this harbor, which will be done early in the ensuing fiscal year.

To complete the existing project there remains the widening of the channel above the Naugatuck Railroad Wharf eastward to the harbor line (about 200 feet), to complete the channel above the bridges and to enlarge the breakwater from the Tongue to the Inner Beacon. The estimated cost of this work has heretofore been reported as $35,000, and the appropriation of $10,000 made in 1894, being applied outside this project would not reduce the cost of completion. But the breakwater has stood so well at its present cross section that it is evident that the estimate for its completion, $15,000, can safely be reduced to $5,000; therefore, with approval of the Chief of Engineers the estimated cost of completion of the existing project is reduced to $25,000.

The annual cost of maintaining the dredged channels in this harbor is estimated at $3,000.

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Appropriations for the improvement of Bridgeport Harbor have been made as follows:

Application.	Date.	Amount.
Dredging outer bar	July 4, 1836	$10,000.00
Dredging outer and inner bars	Aug. 30, 1852	10,000.00
Survey	June 23, 1866	1,985.38
Do	July 11, 1870	500.00
Dredging and 521 feet of breakwater	Mar. 3, 1871	20,000.00
Dredging and 859 feet of breakwater	June 10, 1872	40,000.00
Dredging inner bar and upper harbor	Mar. 3, 1873	30,000.00
Dredging bridge to Long Island Sound (9 feet)	June 23, 1874	20,000.00
Dredging bridge to Long Island Sound (12 feet)	Mar. 3, 1875	15,000.00
Dredging upper harbor (9 feet)	Aug. 14, 1876	10,000.00
Dredging above bridge and outer bar (9 and 12 feet)	June 18, 1878	10,000.00
Dredging bridge to Long Island Sound (12 feet)	Mar. 3, 1879	10,000.00
Do	June 14, 1880	10,000.00
Dredging above Inner Beacon (12 feet)	Mar. 3, 1881	10,000.00
Dredging between Inner Beacon and railroad wharf (12 feet)	Aug. 2, 1882	10,000.00
Do	July 5, 1884	5,000.00
Do	Aug. 5, 1886	20,000.00
Dredging above horse-railroad bridge (9 feet)	Aug. 11, 1888	10,000.00
Dredging and breakwater at Tongue	Sept. 19, 1890	20,000.00
Dredging between Inner Beacon and Naugatuck Wharf	July 13, 1892	20,000.00
Dredging outer bar (15 feet)	Aug. 17, 1894	10,000.00
Total		$292,485.38

Bridgeport, the port of entry for the collection district of Fairfield, is situated about 2 miles from Long Island Sound, at the head of Bridgeport Harbor.

There is a light-house at the entrance to the harbor, and a small harbor light at the Inner Beacon.

Fort Hale, New Haven Harbor, the nearest work of defense, is 18 miles east.

Money statement.

July 1, 1894, balance unexpended		$344.40
Amount appropriated by act of August 17, 1894		10,000.00
		10,344.40
June 30, 1895, amount expended during fiscal year		3,618.21
July 1, 1895, balance unexpended		6,726.19
July 1, 1895, outstanding liabilities	$3,437.23	
July 1, 1895, amount covered by uncompleted contracts	2,477.33	
		5,914.56
July 1, 1895, balance available		811.63
Amount (estimated) required for completion of existing project		25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

*Abstract of proposals for dredging in Bridgeport Harbor, Connecticut, * * * opened by Lieut. Col. H. M. Robert, Corps of Engineers, at New York City, October 16, 1894.*

No.	Name and address of bidder.	Price per cubic yard.	Cubic yards based on price bid.
		Cents.	
3	Chas. & H. E. Du Bois, 119 South street, New York City	13	61,538
4	J. H. Fenner, 380 Communipaw avenue, Jersey City	14	57,143
6	Alonzo J. Beardsley, Bridgeport, Conn.*	11¼	69,565
7	Alonzo E. Smith, Islip, N. Y.	14½	55,172
8	Elijah Brainard, 24 State street, New York City	15¼	51,613
9	The Hartford Dredging Co., Hartford, Conn	16	56,250

* Lowest bid; accepted. Contract entered into October 29, 1894. Work in progress.

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COMMERCIAL STATISTICS FOR CALENDAR YEAR 1894.

[Through courtesy of Capt. John McNeil, harbor master at Bridgeport.]

Arrivals and departures of vessels.

[Draft, 6 to 18 feet; tonnage, 50 to 1,250 tons.]

Kind of vessels.	Number of round trips.	Aggregate tonnage of all trips.
Steamers	7,941	1,329,749
Sailing vessels	4,727	
Barges	5,904	
Total	18,572	1,329,749

Freight received and shipped by water.

	Tons.	Estimated value.
Receipts	700,239	$28,731,627
Shipments	268,420	27,552,667
Total	968,659	56,284,294

Number of vessels repaired during 1894, 79.

The above figures show a total tonnage of freight of 968,659 tons, being an increase of 85,886 tons since 1893, when 882,793 tons were reported.

No new line of transportation has been established since July 1, 1894.

"In addition to the inclosed report of Bridgeport may be added the sale of $300,000 worth of oysters since our last annual report of 1893 and 1894. This industry employed 230 vessels, 19 steamers, and over 200 sloops and schooners as buyers."

D 9.

IMPROVEMENT OF BLACK ROCK HARBOR, CONNECTICUT.

This harbor, 1½ miles long from northeast to southwest and 300 to 2,500 feet wide, lies between the mainland on the west and Fayerweather Island on the east, and includes the navigable part of Cedar Creek, a small tidal inlet which extends up into the western part of the city of Bridgeport and affords water communication of great value to several large manufactories in its immediate neighborhood. It is in the interest of the city of Bridgeport that the improvement of Black Rock Harbor is desired.

The depth in the lower part of the harbor is from 6 to 12 feet at mean low water. This part of the harbor was formerly much used as a refuge for vessels overtaken by storms, but it is not deep enough for most vessels now engaged in commerce through the Sound. Before work was done in Cedar Creek the depth there was from 2 to 4 feet, and the channel was narrow and crooked.

The head of the harbor was separated from Long Island Sound on the southeast by a broad, flat sand bar, which was bare at about half tide, and which joined Fayerweather Island with the mainland.

PROJECTS FOR IMPROVEMENT.

Between 1836 and 1838 $21,500 were expended in building a sea wall across a breach in the southern part of Fayerweather Island to preserve the light-house reservation at the south end of the island and to prevent shoaling on the anchorage ground.

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In 1882 a survey of the harbor was ordered by Congress, which was made in 1883. In his report on this survey, dated December 12, 1883, Colonel McFarland, U. S. Engineers, submitted a project providing—

1. For protecting the upper part of the harbor from the sea by building a breakwater over the bar northeast of Fayerweather Island, to be about half a mile long and 6 feet wide at the top, which was to be 3½ feet above mean high water or 10 feet above low water.

2. For making a channel 80 feet wide and 6 feet deep at mean low water, extending up Cedar Creek.

The estimated cost was—

Breakwater	$58,000
Dredging	22,000
Total	80,000

Work under this project was begun in 1885, and up to July 1, 1894, the breakwater had been built to its full length in order to prevent the currents from cutting a channel across the bar, but its cross section was less than designed, both in height and width; also a channel 6 feet deep or over had been dredged, with width of 80 feet, extending from deep water northward up Cedar Creek to within 500 feet of the head of the creek, being 2,200 feet north of the Forge Company's Wharf. This channel was further widened and deepened in places by private parties. The projected channel was thus completed, and as the breakwater appeared to serve fully the purpose for which it was intended, no further work upon it appeared necessary, and the project was reported completed.

In 1893 and 1894 certain repairs to the old sea wall at Fayerweather Island were made under an allotment of $3,500 from the appropriation of July 13, 1892, for examination, surveys, and contingencies of rivers and harbors.

A sketch of Black Rock Harbor was printed in the Annual Report of the Chief of Engineers for 1893, page 944.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

By the river and harbor act of August 17, 1894, $2,500 was appropriated for continuing this improvement. As there was no existing project for further improvement, by authority of the Secretary of War the appropriation was applied to further needed repairs of the old sea wall on Fayerweather Island.

Three spur jetties of riprap, each about 45 feet long, were built on the west side of the sea wall to check the erosion which was undermining the wall; 250 tons of riprap were placed along the base of the wall, where the bottom had already partly scoured away; the sea wall was extended 55 feet northward to cover a gap in the sandy island, and 165 linear feet of the wall which had been damaged by storms was repaired. Work was done by David V. Howell, under two informal contracts, after advertising for proposals by public notice circular, he being the lowest bidder in each case. Under the first contract work was begun October 23, 1894, and completed March 5, 1895, 324 tons of stone being placed in the spur jetties, at $1.37 per ton, and 100 tons in extension and 422 tons in the repairs, at $2.27 per ton. Under the second contract work was begun March 21, 1895, and completed April 20, 1895, 50 tons of old stone being relaid, at $2.57 per ton, and 250 tons of riprap placed along the sea wall, at $1.47 per ton.

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PRESENT CONDITION OF IMPROVEMENT.

The breakwater between Fayerweather Island and the mainland is built to its full length, 2,744 feet, but not to the cross section first proposed. So far it serves the purpose for which it was designed, and its enlargement is not necessary at present.

The 6-foot channel has been dredged to the head of navigation in Cedar Creek, the east branch of the harbor, with full projected depth and width. Additional dredging to widen and deepen the channel in places has been done by private parties.

No further work being now necessary under the project of 1884, that project is considered completed.

The sea wall built across a breach in Fayerweather Island in 1836–1838, and repaired in 1894 and 1895, still closes the breach and preserves the island. The parts repaired and rebuilt are in good condition. Other considerable repairs are necessary to put the whole work in safe condition.

PROPOSED OPERATIONS.

The project for this improvement has been completed as far as is now necessary, and no further work under it is now proposed.

When funds can be made available it will be desirable to thoroughly repair the old sea wall on Fayerweather Island.

Appropriations for the improvement of Black Rock Harbor, Connecticut, have been made as follows:

Application.	Date.	Amount.
Building sea wall on Fayerweather Island	1836–1838	$21,500.00
Survey	Aug. 2, 1882	350.00
Building breakwater and dredging	July 5, 1884	20,000.00
Dredging	Aug. 5, 1886	5,000.00
Do	Aug. 11, 1888	10,000.00
Do	Sept. 19, 1890	5,000.00
Do	July 13, 1892	5,000.00
Repair of old sea wall on Fayerweather Island, allotment from appropriation for examinations, surveys, and contingencies	....do....	3,448.97
Repair of old sea wall on Fayerweather Island	Aug. 17, 1894	2,500.00
Total		72,798.97

Black Rock Harbor is in the Fairfield collection district, of which Bridgeport is the port of entry. There is a light-house at the harbor entrance. Fort Hale, New Haven Harbor, the nearest work of defense, is 20 miles east.

Money statement.

July 1, 1894, balance unexpended	$305.19
Amount appropriated by act of August 17, 1894	2,500.00
	2,805.19
June 30, 1895, amount expended during fiscal year	2,805.19

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Abstract of proposals for furnishing and placing stone and repairing the sea wall at Black Rock Harbor, Connecticut, opened by Lieut. Col. H. M. Robert, Corps of Engineers, New York City, October 10, 1894.

No.	Name and address of bidder.	Furnishing, placing, and building three spur jetties (500 tons).	Sea wall; furnishing and placing stone and handling old stone (500 tons).	Furnishing and delivering stone upon the beach (500 tons).	Amount of bid.
1	Thos. Ritch & Son, 616 East Seventeenth street, New York City	$1.50	$2.50	$1.25	$2,000
2	Humphrey Toomey, Guilford, Conn	1.68	2.18	1.19	1,930
3	David V. Howell, 202 Broadway, New York City*	1.37	2.27	.....	1,820
4	John A. Bonker, 110 Wall street, New York City	1.75	3.00	1.75	2,375

* Lowest bid; accepted. Work completed March 5, 1895.

Abstract of proposals for stone for Black Rock Harbor, Connecticut, received in answer to public-notice advertisement dated February 1, 1895, and opened February 11, 1895, by Lieut. Col. H. M. Robert, Corps of Engineers.

No.	Name and address of bidder.	Price per ton, 2,240 pounds; stone for protection of sea wall (350 tons).	Price per ton, 2,240 pounds; replacing old stone (50 tons).	Amount of bid.
1	Thos. Ritch & Son, 616 East Seventeenth street, New York City	$1.62	$0.96	$721
2	Toomey Bros., Guilford, Conn	1.50	2.50	650
3	David V. Howell, 202 Broadway, New York City*	1.47	2.57	643

* Lowest bid. Work completed April 20, 1895.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1894.

[Furnished by courtesy of Capt. John McNeil, harbor master at Bridgeport, Conn.]

Arrivals and departures of vessels.

[Draft, 6 to 12 feet; tonnage, 50 to 550 tons.]

Kind of vessels.	Number of vessels.	Aggregate tonnage of all trips.
Steamers	53	60,850
Sailing vessels	66	
Barges	220	
Total	339	60,850

Freight received and shipped by water.

Chief articles.	Tons.	Estimated value.
Coal, iron, and lumber	45,701	$208,127.95
Miscellaneous (not otherwise included)	8,268	281,976.83
Total	53,969	490,104.78

The above figures show a decrease in tonnage of freight of 579 tons below that reported for 1893.

No new line of transportation has been established since July 1, 1894.

Since July 1, 1894, a coal yard, a lumber yard, and an asphalt concern have located upon this harbor, to take advantage of the facilities afforded for receiving materials.

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D 10.

IMPROVEMENT OF SAUGATUCK RIVER, CONNECTICUT.

The navigable part of this river is a tidal inlet extending from the village of Westport southerly to Long Island Sound, a distance of about 4½ miles by course of channel. For nearly 2 miles below Westport the stream is only from 200 to 1,200 feet wide; below this it expands into a rather broad inner bay with a narrow channel following the west, south, and east shores, and then turning abruptly to the southeast and passing to the Sound between Cedar Point on the north and Cockenoes Island on the south. On the south side of the inner bay lies "Great Marsh," which is connected with Cockenoes Island by a broad sand flat, nearly bare at low tide, and east of the island a reef of bowlders extends eastward 1½ miles, so that the only entrance to the harbor at low tide is to the eastward of this reef.

A mile and a half below Westport lies the settlement and railroad station of Saugatuck on the west bank of the river. Before 1830 the village of Westport was known as Saugatuck.

The navigable part of the river is crossed by three bridges, all having draws of sufficient size for the commerce of the stream. The uppermost is a wagon bridge at Westport; 1¼ miles below is a wagon bridge near Saugatuck, and a quarter of a mile farther down is the bridge of the New York, New Haven and Hartford Railroad.

The mean rise of tide is about 7 feet.

From Long Island Sound to the railroad bridge the natural available depth of water was about 5½ feet at mean low tide, with a channel generally narrow and circuitous; above the railroad bridge the channel was fairly straight with a low-water depth diminishing to practically nothing at Westport. Several rocks lying in or close to the channel are sources of some danger to navigation.

PROJECTS FOR IMPROVEMENT.

Improvements at this locality have been made by the United States under the several titles of Saugatuck Harbor, Cedar Point, Westport Harbor, and Saugatuck River.

Upon petition of citizens of Westport (then Saugatuck) Congress appropriated, May 20, 1826, $400 for a survey of the river and harbor of Saugatuck, in order to determine "the expediency and expense of removing the obstructions to navigation" in the river, and "of facilitating the commercial intercourse between the port of Saugatuck and the city of New York." The survey was made by Lieutenant-Colonel Anderson in 1826, and in his report a project for improvement was submitted, consisting in deepening the channel by from 1 to 1½ feet from Westport for 459 yards downstream, removal of two rocks in the river, and building a breakwater on Cedar Point to prevent its washing away, all at a cost of $600; and further, in cutting a canal through "Great Marsh" to save the distance around Cockenoes Island for westbound vessels, excavating and banking up 31,860.94 cubic yards of material at a cost of $5,628.65, the total cost of the projected improvement being $6,128.65. This did not include stone for a wall along part of the east bank of the canal, which was stated could be procured at a small cost if needed.

Under this project six different appropriations were made and the work was completed, practically as designed, in 1839.

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It is not known what dredging was done in the river or what obstructions were removed, but the amount of such work is believed to be small.

The breakwater on Cedar Point was begun in 1827 and completed in 1837. It was made about 390 feet long and 10 feet wide on top, the top being 4 feet above mean high water, under two appropriations, one of $1,500, March 2, 1827, for removing obstructions in the river and protecting the harbor at Cedar Point, and one of $1,000, July 4, 1836, for further securing the beach at Cedar Point. It is believed that nearly all of both appropriations were applied to the breakwater.

In 1836-1840 the canal was cut through Great Marsh, extending from a bend in the channel in the inner bay to the Sound, and thus saving the distance around Cockenoes Island and the reef east of it, and shortening the distance between Westport and points west by about 4 miles. The canal was made 68 feet wide at high water, 44 feet wide at bottom, and was 1,350 feet long, exclusive of the dredging required to connect it with deep water at either end. It was first made 2 feet deep at mean low water, and subsequently, under appropriation of July 7, 1838, deepened to 4 feet. Part of the east side was also protected by a dry wall, and in line of this wall a beacon was built to mark the entrance from the Sound. The canal was built under three appropriations for improving Westport Harbor, made in 1836, 1837, and 1838, and aggregating $11,516. It filled up so rapidly that since 1850 it has been of little use.

The next appropriation made for this harbor was $2,500, March 2, 1867. Proposals were invited for extending the sea wall on Cedar Point and for removing three rocks above the railroad bridge, but the prices offered were considered too high; $410.10 was expended in advertising, in examination of the harbor, and preparing estimates of cost of work, and it was reported that the work necessary was removal of rocks, extension and repair of sea wall, and repair of canal and canal wall, at a probable cost of $12,150. The unexpended balance of this appropriation reverted to the Treasury by act of Congress of July 12, 1870, but was reappropriated by act of March 3, 1871.

July 11, 1870, $2,500 was appropriated for improving Westport Harbor, which was expended the same fiscal year in repair of the breakwater on Cedar Point. About 64 feet of the old work was rebuilt and it was extended northwardly 43¾ feet, making its total length about 434 feet; the new work was 5½ feet wide on top and from 1 to 1½ feet higher than the old wall.

The reappropriated balance of the appropriation of 1867 was considered too small to effect any useful improvement, and was applied in 1872 to making a survey of the whole length of the river and harbor.

In 1883 an examination of this harbor was made in pursuance of the river and harbor act of August 2, 1882. The officer in charge recommended that the canal be abandoned, and that a survey be made to determine the cost of excavating a channel 4 feet deep up to the village of Westport as being an improvement worthy to be made, provided it could be done at reasonable cost. A survey was made in accordance therewith, and an estimate of $36,000 submitted for such a channel to be 100 feet wide, including removal of a few bowlders in and near the channel. (See Annual Report of the Chief of Engineers for 1884, Part II, p. 675.)

In 1886, certain citizens of Westport addressed a petition to the Secretary of War urging the reopening of the canal through Great Marsh.

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This petition was printed, in connection with the report upon a preliminary examination, in the Annual Report of the Chief of Engineers for 1891, page 841.

The river and harbor act of 1890 directed a preliminary examination of Saugatuck River, which was made and reported upon under date of January 8, 1891. (Report printed in House Ex. Doc. No. 179, Fifty-first Congress, second session, and in the Annual Report of the Chief of Engineers for 1891, p. 840.)

In the report estimates were presented—

1. For a channel 100 feet wide and 6 feet deep at mean low water up to the village of Westport	$40,000
2. For a channel 60 feet wide and 4 feet deep at mean low water to Westport	10,000
3. For reopening the canal, making it 100 feet wide and 5 feet deep at mean low water	21,000

with recommendations that the improvement of the natural channel should precede any work on the canal.

By the river and harbor act of 1892, $7,000 was appropriated for improving Saugatuck River "to be expended in the improvement of the natural channel," and by approval of the Secretary of War the project was adopted providing for a channel 60 feet wide and 4 feet deep at mean low water to Westport, at an estimated cost of $10,000.

Up to July 1, 1894, the 4-foot channel had been extended to the lower wharf on the east side of the river at Westport, with width of 60 feet except for 550 feet at the upper end, where it was only made 40 feet wide.

A survey of Westport Harbor, ordered by the river and harbor act of 1894, has been made.

A sketch of this river and harbor was printed with the Annual Report of the Chief of Engineers for 1894, page 670.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

By act of Congress of August 17, 1894, $3,000 was appropriated for completing this improvement. Entering into contract for completing this improvement has been delayed in order to make an examination of a ledge, presumably of bowlders, which crosses the channel just below the drawbridge at Westport and which may require a slight change in the layout of the channel.

PRESENT CONDITION OF IMPROVEMENT.

The channel in the river was dredged 4 feet deep and 40 to 60 feet wide in 1893; it is understood that the depth is fairly well maintained.

The Cedar Point Breakwater is partly undermined at its north end and the canal bottom runs bare in places at very low tide. Work at these places is not included under the existing project, but is to be considered in connection with the survey of Westport Harbor, ordered by the river and harbor act of 1894.

PROPOSED OPERATIONS.

With the funds now available it is proposed to complete the improvement as far as now projected, and no further appropriation is asked for under the present approved project.

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Appropriations for this harbor have been made as follows:

Title.	Application.	Date.	Amount.
Survey of river and harbor of Saugatuck	Survey	May 20, 1826	$400
Removing obstructions in river and protecting harbor at Cedar Point.	Chiefly constructing breakwater at Cedar Point.	Mar. 2, 1827	1,500
Removing obstructions in river	As stated, location not known	Apr. 30, 1830	28
For further securing the beach at Cedar Point.	Continuing breakwater	July 4, 1836	1,000
Harbor of Westport	Canal construction	do	3,000
Do	do	May 3, 1837	3,734
Do	do	July 7, 1838	4,782
Deepening and improving Westport Harbor, unexpended balance reverted to Treasury in 1870 reappropriated in 1871.	Chiefly in surveys in 1872	Mar. 2, 1867	2,500
Westport Harbor	Repairing and extending breakwater on Cedar Point.	July 11, 1870	2,500
Saugatuck River, improvement of the natural channel.	Dredging	July 13, 1892	7,000
Saugatuck River, for completion	do	Aug. 17, 1894	3,000
Total			29,444

The appropriations prior to 1870 are copied from House Ex. Doc. No. 64, Forty-eighth Congress, first session. The last two appropriations, amounting to $10,000, are the only ones made under the existing project.

Saugatuck River is in the Fairfield collection district, of which Bridgeport is the port of entry. The nearest light-house is on Sheffield Island, 5 miles southwest from the river's mouth. Fort Hale, New Haven Harbor, about 27 miles east, is the nearest work of defense.

Money statement.

July 1, 1894, balance unexpended	$878.95
Amount appropriated by act of August 17, 1894	3,000.00
	3,878.95
June 30, 1895, amount expended during fiscal year	1.80
July 1, 1895, balance unexpended	3,877.15

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1894.

[Through the courtesy of Mr. E. M. Lees, Westport, Conn.]

Arrivals and departures of vessels.

[Draft, 6 to 8 feet; tonnage, 100 to 250 tons.]

Kind of vessels.	Number.	Number of round trips.	Aggregate tonnage of all trips.
Steamers	2	140	29,400
Sailing vessels	30	112	16,800
Barges	30	68	14,000
Total	62	320	60,200

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Freight received and shipped by water.

Chief articles.	Tons.
Receipts:	
Coal	12,000
Lumber	4,500
Miscellaneous (not otherwise included)	20,000
Total receipts	36,500
Shipments:	
Farm produce	10,000
Starch	7,200
Miscellaneous (not otherwise included)	6,000
Total shipments	23,200

No new lines of transportation have been established since July 1, 1894.

These figures show an increase in tonnage of freights on this river since 1893 of 16,400 tons, due mainly to the establishment of a new industry there.

D 11.

IMPROVEMENT OF NORWALK HARBOR, CONNECTICUT.

Norwalk Harbor or River is a tidal estuary, with a narrow channel extending about 3 miles north from Long Island Sound to the town of Norwalk. Above Norwalk the river is a small fresh-water stream. South Norwalk is on the west bank of the river, 1½ miles below Norwalk. At this point the river is crossed by two drawbridges, the lower one a highway bridge, and the other (450 feet above) the bridge of the New York, New Haven and Hartford Railroad.

In 1867 a company was incorporated under the laws of the State of Connecticut for the improvement of the river. Little work was done, and when improvement was begun by the United States the low-water depth to South Norwalk was 5 feet, and to Norwalk but 1 foot.

PROJECT FOR IMPROVEMENT.

By act of March 2, 1829, Congress appropriated $80 "for making a survey of the harbor of Norwalk, Conn., with a view to its improvement." The survey was made by Capt. Hartman Bache, U. S. Engineers, who, in his report on the same, dated May 10, 1830, recommended excavating the channel, proposing to build a steam dredge for the purpose.

The cost was estimated as follows:

For a channel 12 feet deep at ordinary high water	$15,668.95
For a channel 10 feet deep at ordinary high water	12,286.45

No money was appropriated for carrying out this plan, and in 1871 another survey was ordered by Congress, which was made in the same year.

In his report on the latter survey, dated December 16, 1871 (printed in Senate Ex. Doc. No. 23, Forty-second Congress, second session; also in the Annual Report of the Chief of Engineers for 1872, p. 900). General Warren, U. S. Engineers, submitted a project for dredging a channel 6 feet deep and 100 feet wide from Long Island Sound up to Norwalk, at an estimated cost of $34,000.

In 1880 the terms of the river and harbor act provided that "so much of said appropriation ($5,000) as shall be necessary therefor shall be

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so expended as to have a channel 6 feet deep at low water between the steamboat landing in said Norwalk and Long Island Sound" As a channel of the projected width (100 feet) and depth of 6 feet at mean low water existed, this was interpreted as requiring a depth of 6 feet at extreme low water (see Annual Report of the Chief of Engineers for 1881, Part 1, p. 609), which would be 8 feet at mean low water, and the project was accordingly modified to provide for obtaining that depth up to South Norwalk, where the steamboat landing was. The estimate of total cost, including this modification and the dredging already required for maintenance, was $84,000. In 1892, after this amount had been appropriated and the channel had been dredged practically to the dimensions required, the project was considered completed.

Up to July 1, 1894, the channel below South Norwalk had been made 100 feet wide and 8 feet deep at mean low water, and above South Norwalk it had been made from 60 to 100 feet wide and 6 feet deep.

A sketch of Norwalk Harbor was printed in the Annual Report of the Chief of Engineers for 1885, page 656.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

The river and harbor act of 1894 appropriated $15,000 for continuing this improvement, with the following description of the work proposed:

So much of this appropriation as may be necessary may, in the discretion of the Secretary of War, be expended between the freight depot of the Danbury and Norwalk Railroad Company on the north and Jennings, so called, on the south to remove the flats known as Ferrys Point between the channel and the established harbor line; and any unexpended balance, after completion of the above, may be used for the improvement of the sharp bend in the channel near Keysers Island at the mouth of the harbor: *Provided*, That the United States shall be subjected to no cost for any lands required to make this improvement.

There was no existing project for the improvement of Norwalk Harbor, and, with approval of the Secretary of War, it was decided to apply the whole appropriation in accordance with the permissive terms of the act.

After duly advertising for proposals a contract for dredging at Ferrys Point and, should the funds permit, at Keysers Island was entered into with Alonzo J. Beardsley, under date of November 10, 1894; contract price 14.3 cents per cubic yard.

Work under this contract will begin early in the ensuing year. The contract expires June 30, 1896.

PRESENT CONDITION OF IMPROVEMENT.

The dredged channels are in good condition, retaining nearly the full depth and width made under the project which was completed in 1892.

PROPOSED OPERATIONS.

With the available funds the shoal at Ferrys Point, near Norwalk, will be removed, and should any balance remain the bend near Keysers Island, at the mouth of the harbor, will be widened.

There is no existing project for improvement of this harbor, except the one adopted for expenditure of the last appropriation; therefore no funds are needed for the ensuing year.

A survey of Norwalk Harbor, ordered by the river and harbor act of 1894, has been made and will be reported upon early in the fiscal year.

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Appropriations for improving Norwalk Harbor have been made as follows:

Application.	Date.	Amount.
Survey	Mar. 2, 1829	$80.00
Do	Mar. 3 1871	1, 166.66
Dredging (6 feet) above South Norwalk	June 10, 1872	10, 000.00
Do	Mar. 3, 1873	10, 000.00
Do	June 23, 1874	10, 000.00
Dredging (6 feet) below South Norwalk	Mar. 3, 1875	7, 000.00
Do	June 18, 1878	6, 000.00
Dredging (6 feet) above and below South Norwalk	Mar. 3, 1879	10, 000.00
Dredging (6 feet) below South Norwalk	June 14, 1880	5, 000.00
Dredging (8 feet) below and (6 feet) above South Norwalk	Mar. 3, 1881	5, 000.00
Dredging (6 feet) above South Norwalk	Aug. 2, 1882	5, 000.00
Dredging (8 feet) below South Norwalk	July 5, 1884	5, 000.00
Dredging (6 feet) above South Norwalk	Aug. 5, 1886	3, 000.00
Dredging (6 feet) above and (8 feet) below South Norwalk	Aug. 11, 1888	* 3, 000.00
Do	Sept. 19, 1890	4, 000.00
Do	Aug. 17, 1894	15, 000.00
Total		99, 246.66

* Part of an appropriation of $28,000, of which $25,000 was required to be expended at Wilsons Point.

Norwalk is in the Fairfield collection district, and is 11 miles west of Bridgeport, the port of entry. Norwalk Light-House is on Sheffield Island, at the harbor entrance. The nearest work of defense is Fort Schuyler, Throgs Neck, at the head of Long Island Sound, about 29 miles southwest.

Money statement.

Amount appropriated by act of August 17, 1894	$15, 000.00
June 30, 1895, amount expended during fiscal year	799.28
July 1, 1895, balance unexpended	14, 200.72
July 1, 1895, amount covered by uncompleted contracts	12, 155.00
July 1, 1895, balance available	2, 045.72

*Abstract of proposals for dredging in Norwalk Harbor, Connecticut, * * * opened by Lieut. Col. H. M. Robert, Corps of Engineers, at New York City, October 16, 1894.*

[Amount available, $12,000.]

No.	Name and address of bidder.	Price per cubic yard.	Cubic yards based on price bid.
		Cents.	
1	Emory R. Seward, Albany, N. Y	11.5	104, 348
3	Chas. & H. E. Du Bois, 119 South street, New York, N. Y	18	66, 667
4	J. H. Fenner, 380 Communipaw avenue, Jersey City, N. J	30	40, 000
6	Alonzo J. Beardsley, Bridgeport, Conn.*	14.3	83, 916
7	Alonzo E. Smith, Islip, N. Y	19.5	61, 538
8	Elijah Brainard, 24 State street, New York, N. Y	18	66, 667
9	The Hartford Dredging Co., Hartford, Conn	16	75, 000
10	Newburg Dredging Co., Newburg, N. Y	14.5	82, 759

* Contract awarded to second lowest bidder. Contract entered into November 10, 1894. Work not yet begun.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1894.

The last statement of commerce of this river received was for the year 1891, when 368,500 tons was reported.

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D 12.

IMPROVEMENT OF HARBOR AT WILSONS POINT, CONNECTICUT.

Wilsons Point Harbor is a bay on the north shore of Long Island Sound, about 1½ miles west from the mouth of Norwalk River or Harbor.

The lower half of the harbor is about half a mile wide, with depth decreasing from 16 feet gradually to 6 feet at Wilsons Point; the upper half is from 1,000 to 500 feet wide, with depth of 3 feet or less at low tide. The harbor is sheltered by the mainland and by Sheffield Island (the most westerly of the Norwalk Islands) from all quarters except the southwest; it is partly sheltered from the southwest by Bell Island, an island separated from the mainland by a marsh and narrow creek.

Wilsons Point Harbor has been used to some extent for many years as a harbor of refuge and place to lie up for the night by fishing boats and oyster steamers, and occasionally by barges caught out in storms.

There is no settlement upon the shores of the harbor, except a collection of summer cottages on Bell Island.

A few years ago (probably about 1880) the Danbury and Norwalk Railroad Company (now a branch of the Housatonic Railroad Company) made Wilsons Point their terminus, and subsequently the New England Terminal Company was formed to construct docks, car yards, and coal sheds, and to operate in the interest of the Housatonic Railroad and its connections. A large dock was built, with transfer bridges, by which freight cars were taken on board steamers, and freight carried to New York City without unloading and reloading.

At that time the Housatonic Railroad was allied to the New York and New England Railroad system, which had no direct access to New York City so available as that afforded by the harbor at Wilsons Point. Subsequently (about 1892) the Housatonic Railroad was leased by another corporation, the New York, New Haven and Hartford Railroad, which had other and better entrances to New York City, and the terminal facilities at Wilsons Point have been less used since.

PROJECTS FOR IMPROVEMENT.

March 3, 1888, a letter was sent by the Hon. William P. Frye, U. S. Senator, to the Secretary of War, asking that a special examination of Norwalk Harbor be made, with reference to developing business which urgently required further improvements. This letter was referred to Col. D. C. Houston, Corps of Engineers, for report. His report (printed in the Annual Report of the Chief of Engineers for 1889, p. 709) stated that it was learned that the business referred to was that of the railroad terminus at Wilsons Point, and that it was desired that the United States undertake dredging a channel 15 feet deep and 300 feet wide up the harbor to the vicinity of the railroad wharves. There was no money available for a detailed examination of the locality, but estimates for dredging, based upon recent U. S. Coast Survey charts, were made as follows:

230,000 cubic yards, at 20 cents	$46,000
Contingencies, 15 per cent	6,900
Total	52,900

The report suggested that there seemed to be no objection to extending the wharves out to the 15-foot curve, which would obviate the necessity of other improvements.

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The river and harbor act of 1888 made appropriations for Norwalk Harbor, Connecticut, of $28,000, with provision as follows:

Twenty-five thousand dollars of which shall be expended in dredging and deepening the channel in the lower harbor up to Wilsons Point.

Under this appropriation the dredging originally desired was completed in 1889, 205,586 cubic yards of material being dredged, which, with a considerable amount of work done by the Terminal Company, gave a channel of 400 feet width; and no further appropriation was asked for.

In 1890 $30,000 was appropriated for this harbor and was expended in 1891–92 in widening and extending the channel.

Up to July 1, 1894, the channel close to the docks had been dredged by the Terminal Company to 12 feet depth at mean low water; outside this the channel had been made 15 feet deep at mean low water to Long Island Sound, and 700 feet wide with an additional width of 200 feet on the east side for a distance of 750 feet south from the wharves; the 15-foot channel had also been extended northward parallel to the wharves and 75 feet westward from them, with 200 feet width.

A sketch of the harbor at Wilsons Point was printed in the Annual Report of the Chief of Engineers for 1893, page 950.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

Nothing was done.

PRESENT CONDITION OF IMPROVEMENT.

The channels, as above described, remain in good condition.

PROPOSED OPERATIONS.

The improvement of this harbor is completed as far as now designed. No further work is projected and no appropriation is required.

Appropriations for improving harbor at Wilsons Point have been made as follows:

Application.	Date.	Amount.
Dredging*	Aug. 11, 1888	$25,000
Do	Sept. 19, 1890	30,000
Total		55,000

*Part of an appropriation of $28,000 for Norwalk Harbor, directed by the appropriation act to be expended at Wilsons Point.

Wilsons Point is in the Fairfield collection district, and is about 14 miles southwest from Bridgeport, the port of entry. Norwalk light-house, on Sheffield Island, is about half a mile south of the harbor. The nearest work of defense is Fort Schuyler, Throgs Neck, at the head of Long Island Sound, about 29 miles southwest.

Money statement.

July 1, 1894, balance unexpended	$1,323.10
June 30, 1895, amount expended during fiscal year	500.00
July 1, 1895, balance unexpended	823.10

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COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1894.

[Through courtesy of Hon. E. J. Hill, M. C., Norwalk, Conn.]

Arrivals and departures of vessels.

[Draft, 4 to 18 feet; tonnage, not recorded.]

Kind of vessels.	Number of round trips.
Steamers (oyster steamers, 400; tugboats, 75)	475
Sailing vessels	10
Barges	292
Total	777

Aggregate tonnage of all trips not ascertained.

Freight received and shipped by water.

Chief articles.	Tons.
Receipts:	
Oil	42,250
Coal	56,277
Miscellaneous (not otherwise included)	2,000
Total receipts	100,527
Shipments, stone	1,500

Estimated value not ascertained.

No new lines of transportation have been established since July 1, 1894.

The above figures show an increase on tonnage of freights of 24,275 tons since 1893, when 77,752 tons were reported, and it is anticipated that the reports for 1895 will show a still greater increase.

D 13.

IMPROVEMENT OF FIVE MILE RIVER HARBOR, CONNECTICUT.

This harbor is an inlet on the north shore of Long Island Sound, about 2 miles west of the mouth of Norwalk Harbor, Connecticut. It is about 1 mile long and from 300 to 800 feet wide. About three-fourths of a mile above its mouth it runs bare at low tide. At the mouth the natural low-water depth was 3 feet, increasing to 9 feet at a point 750 feet out into the Sound. The mean rise of the tide is about 7 feet.

Since 1848 Five Mile River has been largely engaged in oyster growing, and in this business now employs about 140 vessels.

These vessels could only enter or leave the harbor at high tide. Consequently during their busy season they were obliged to lie up for the night at other and less convenient harbors.

PROJECT FOR IMPROVEMENT.

By an act of Congress approved August 5, 1886, a survey or examination of this harbor was ordered, which was made in the following fall, and reported on under date of December 7, 1886. (Report printed in the Annual Report of the Chief of Engineers for 1887, Part I, p. 639.)

In this report a project for improvement was proposed which consisted in dredging a channel 8 feet deep at mean low water and 100 feet wide, to extend up the harbor and to be about 6,000 feet long. The project was adopted in 1888, when work under it was ordered by appropriation of $5,000 made by act of Congress of August 11, 1888. The original estimate for completion was $25,000, based upon prices for such work in 1886; these prices were lower than have since been offered, and in 1894 it was found necessary to increase the estimate of cost by $20,000,

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making it $45,000 from the beginning. (Annual Report of the Chief of Engineers for 1894, p. 675.)

Up to July 1, 1894, 82,938 cubic yards had been dredged under this project, making the channel about 3,580 feet long, 60 feet wide, and 8 feet deep at mean low water.

Harbor lines were established for this harbor by the Secretary of War, January 26, 1892.

A sketch of Five Mile River Harbor was printed in the Annual Report of the Chief of Engineers for 1894, page 676.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

By the river and harbor act of 1894, $2,500 was appropriated for continuing this improvement. After advertising for proposals a contract was entered into with J. H. Fenner, under date of December 20, 1894, for extending the channel by dredging about 15,000 cubic yards of material at the rate of 13½ cents per yard.

Work under this contract will begin early in the ensuing year.

PRESENT CONDITION OF IMPROVEMENT.

Under the existing project the channel has been dredged from deep water in Long Island Sound about 3,580 feet up the harbor, with width of 60 feet and depth of 8 feet at mean low water. It retains its depth fairly well, the only shoaling reported being a slight falling in of the banks.

PROPOSED OPERATIONS.

Under the contract now in force the 8-foot channel of 60 feet width will be extended about 1,000 feet upstream.

With future appropriations it is proposed to widen and extend the channel as provided for in the project for improvement.

Appropriations for improving harbor at Five Mile River, Connecticut, have been as follows:

Application.	Date.	Amount.
Dredging	Aug. 11, 1888	$5,000
Do	Sept. 19, 1890	5,000
Do	July 13, 1892	5,000
Do	Aug. 17, 1894	2,500
Total		17,500

Five Mile River is in the Fairfield collection district and is about 13 miles west of Bridgeport, the port of entry. The nearest light-house is on Sheffield Island, nearly 2 miles from the mouth of the harbor. The nearest work of defense is Fort Schuyler at the head of Long Island Sound, 27 miles southwest.

Money statement.

July 1, 1894, balance unexpended	$334.15
Amount appropriated by act of August 17, 1894	2,500.00
	2,834.15
June 30, 1895, amount expended during fiscal year	3.85
July 1, 1895, balance unexpended	2,830.30
July 1, 1895, amount covered by uncompleted contracts	1,975.00
July 1, 1895, balance available	855.30
Amount (estimated) required for completion of existing project	27,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

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Abstract of proposals for dredging in Five Mile River Harbor, Connecticut, opened by Lieut. Col. H. M. Robert, Corps of Engineers, at New York City, December 1, 1894.

No	Name and address of bidder.	Price per cubic yard, scow measure.	Number of cubic yards based on price bid.
		Cents	
1	The Hartford Dredging Co., Hartford, Conn	14½	13,793
2	Alonzo E Smith, Islip N. Y	14 7/10	13,996
3	A. J Beardsley & Son, Bridgeport, Conn	13 9/10	14,388
4	J. H Fenner, Jersey City, N. J.*	13½	14,815
5	Newburgh Dredging Co. Newburg, N. Y	13½	14,492
6	Elijah Brainard, New York City	14½	14,035

* Lowest bid: recommended. Entered into contract December 20, 1894; work not yet begun. The contract expires November 30, 1895.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1894.

[Through courtesy of Mr. Charles W. Bell, Rowayton, Conn.]

Arrivals and departures of vessels.

Kind of vessels.	Number of round trips.
Steamers (oyster steamers)	400
Sailing vessels	325
Barges	14
Total	739

Draft and tonnage not reported. Aggregate tonnage of all trips not ascertained.

Freight received and shipped by water.

Chief articles.	Tons.	Estimated value.
Receipts:		
Coal, oysters	3,350	$137,450
Miscellaneous, not otherwise included	248	(*)
Total receipts	3,598	137,450
Shipments:		
Oysters, produce, etc., of which 4,000 tons were oysters for shipment to Europe	4,700	194,220
Other transactions in oysters and clams—sales to dealers, planters, and consumers—about	3,000	110,452
Total shipments	7,700	304,672

* Not reported.

No new lines of transportation have been established since July 1, 1894.

No statistics were furnished for 1893, but it is reported that there was in 1894 "some falling off in volume of business and in prices, attributed to the general depression."

D 14.

IMPROVEMENT OF STAMFORD HARBOR, CONNECTICUT.

This harbor is on the north shore of Long Island Sound about 6 miles east of the New York State line. The harbor consists of a bay about a mile long and a mile broad, at the head of which two channels

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extend up nearly a mile toward the middle of the city. The West Branch is the mouth of Mill River, a small stream dammed at Oliver Street Bridge, the head of the harbor. The original low-water depth for a mile below the bridge was from 1 to 3 feet in a crooked channel and the 7-foot curve in the bay was about 7,500 feet below the bridge. All the wharves are in the upper half of this distance. The East Branch was originally a crooked stream running through salt marshes; it was straightened and deepened by private enterprise and was known as the "canal." Though nominally under control of the corporation which deepened it, the East Branch has been for a long time practically, and recently has been formally, opened to free public use. In 1892 it had an available depth of 6½ feet at mean low water with width of about 60 feet nearly to its head.

The mean rise of tide in Stamford Harbor is about 7.4 feet.

PROJECTS FOR IMPROVEMENT.

By act of March 2, 1829, Congress appropriated $100 for making a survey of the harbor of Stamford, Conn., with a view to its improvement. The survey was made by Capt. Hartmann Bache, U. S. Engineers, in 1829. In his report on the same, dated May 10, 1830, Captain Bache recommended excavating the channel (proposing to build a steam dredge for the purpose), the cost being estimated as follows:

For a channel 12 feet deep at ordinary high water (about 4 feet at mean low water)	$13,250.00
For a channel 10 feet deep at ordinary high water	11,035.20

No money was appropriated for carrying out this plan.

The river and harbor act of 1882 authorized a survey of this harbor, which was made in the following year. In his report on this survey, dated December 12, 1883 (printed in Senate Ex. Doc. No. 50, Forty-eighth Congress, first session; also in Annual Report of the Chief of Engineers for 1884, Part I, p. 672), Lieutenant-Colonel McFarland, Corps of Engineers, submitted a project for dredging a channel 80 feet wide and 5 feet deep at mean low water from deep water in the bay up the West Branch of the harbor to Oliver Street Bridge, estimated to cost as follows:

Dredging 80,000 cubic yards of mud, at 20 cents	$16,000
Contingencies	4,000
Total	20,000

It was not intended to include the removal of the ledge under and just below the bridge.

The beginning of the work under this project was approved by the Secretary of War August 30, 1886, after the first appropriation for improving the harbor had been made, and in December, 1891, after appropriations equal to the estimated cost of the work had been made and expended, the project was considered practically completed. The channel of the West Branch had been made 5 feet deep at mean low water and about 80 feet wide up to within 1,000 feet of the head of the harbor. Near the head of the harbor the width was from 50 to 70 feet; at the bends of the channel the width had been made from 100 to 140 feet.

Under the river and harbor act approved September 19, 1890, a survey of Stamford Harbor was made, the report of which, dated September 16, 1891, was printed in the Annual Report of the Chief of Engineers for 1891, Part I, page 849 et seq. This report presents a project for

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enlarging the channel of the West Branch of the harbor to accommodate the growing commerce of Stamford, and estimates were submitted as follows:

Dredging to make the channel 150 feet wide and 7 feet deep at mean low water, 190,000 cubic yards, at 21 cents	$39,900	
Contingencies and supervision, about	6,100	
		$46,000
Dredging to make the basin between harbor lines at the head of the harbor 7 feet deep, 150,000 cubic yards, at 28 cents	42,000	
Contingencies and supervision, about	7,000	
		49,000
Total estimated cost		95,000

The river and harbor act of July 13, 1892, appropriated $15,000 for improving harbor at Stamford, Conn., with proviso that not less than one-half the sum should be expended on the East Branch. This appropriation was evidently based upon the survey of 1890–91, which was before Congress at the time, and also upon a desired improvement of the East Branch which had not been asked for at the time when the survey was made. Therefore the East Branch was surveyed and a project submitted for making the channel 9 feet deep at mean low water, to be 100 feet wide for a length of 8,535 feet and 50 feet wide for about 1,200 feet, to the head of navigation, by dredging and removing rocks and bowlders, at an estimated cost of $28,500. The plans for improvement of both branches were adopted, and the project of 1892 now consists of—

Dredging to make the channel in the West Branch 150 feet wide and 7 feet deep at mean low water, 190,000 cubic yards, at 21 cents	$39,900
Dredging to make the basin between harbor lines at the head of the West Branch 7 feet deep at mean low water, 150,000 cubic yards, at 28 cents	42,000
Dredging to make the channel in the East Branch 9 feet deep at mean low water, 100 feet wide to the steamboat wharf, a distance of about 8,535 feet, and 50 feet wide for 1,200 feet farther, 160,000 cubic yards, at 16 cents	25,600
Contingencies, inspection, etc., estimated at	16,000
Total estimated cost of project of 1892	123,500

July 1, 1894, the channel of the West Branch, dredged under the project adopted in 1886 and completed in 1891, was in fair condition. No work in this channel had been done under the project of 1892 except to deepen two small shoals. The channel of the East Branch was 60 feet wide and 9 feet deep at mean low water up to Hoyts Dock; thence to the Steamboat Dock it was 60 feet wide and from 8 to 9 feet deep; thence to the head of the channel it was 40 to 60 feet wide and 8 feet deep.

Harbor lines were established in the West Branch of this harbor by action of the Secretary of War dated February 28, 1890.

A sketch of the entire harbor was printed in the Annual Report of the Chief of Engineers for 1893, page 956.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

At the beginning of the fiscal year an agreement had been made, with approval of the Chief of Engineers, to apply the remainder of the appropriation of 1892 to the removal of certain bowlders lying very close to the edge of the channel in the East Branch of the harbor. A large dredge was employed for eight days, some blasting was done, and 13 bowlders were removed, ranging in size from about 5 to 70 cubic feet. The total cost of this work, including inspection, was $703.85. The

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rate obtained for the dredging plant was exceptionally low, due to the fact that but little dredging work was going on at the time.

The river and harbor act of 1894 appropriated $10,000 for this improvement, with the proviso that not less than half the amount should be spent on the East Branch. Advertisement was made for proposals for dredging, and, under date of January 14, 1895, a contract was entered into with the Hartford Dredging Company to excavate and remove about 65,000 cubic yards of material, work in the East Branch to be paid for at the rate of 12 cents per cubic yard for mud and sand and $8.90 per hour's work upon dredging out rocks, and work in the West Branch at the rate of 9.6 cents per cubic yard of dredged material. Work under this contract has not yet begun; the contract expires December 31, 1895.

PRESENT CONDITION OF IMPROVEMENT.

The channel of the West Branch is 5 feet deep at mean low water and 80 feet wide or more up to within 1,000 feet of its head, for which distance the width is from 50 to 80 feet, as made under the completed project of 1886. The only work done in the West Branch under the existing project of 1892 was the removal of two small shoals in 1893.

The channel of the East Branch is 60 feet wide and 9 feet deep at mean low water up to Hoyt's Dock; thence to the steamboat dock it is 60 feet wide with depths from 8 to 9 feet; thence to the head of navigation it is 40 to 60 feet wide and 8 feet deep.

PROPOSED OPERATIONS.

Under the contract now in force the channel of the East Branch will be widened and the projected work in that part will be about two-thirds completed; a beginning will also be made upon the projected deepening of the West Branch channel.

Future appropriations will be applied to making and maintaining the dredged channels in both branches of the harbor as provided by the existing project. The estimated cost of completion is $98,500, of which about $10,000 is estimated for completion of work upon the East Branch and $88,500 for completion of the work contemplated in the West Branch.

Appropriations for improving Stamford Harbor, Connecticut, have been made as follows:

Application.		Date.	Amount.
Survey		Mar. 2, 1829	$100
Do		Aug. 2, 1882	350
Dredging, West Branch		Aug. 5, 1886	10,000
Do		Aug. 11, 1888	5,000
Do		Sept. 19, 1890	5,000
Dredging, East Branch	$13,800	July 13, 1892	*15,000
Dredging, West Branch	1,200		
Dredging, East Branch	5,000	Aug. 17, 1894	*10,000
Dredging, West Branch	5,000		
Total			45,450

* These appropriations, amounting to $25,000, are made under the existing project of 1892.

Stamford Harbor is in the Fairfield collection district, of which Bridgeport is the port of entry. There is a light-house on the middle ground at the harbor entrance. The nearest work of defense is Fort Schuyler, Throgs Neck, 20 miles to the southwest.

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Money statement.

July 1, 1894, balance unexpended	$726.29
Amount appropriated by act of August 17, 1894	10,000.00
	10,726.29
June 30, 1895, amount expended during fiscal year	716.32
July 1, 1895, balance unexpended	10,009.97
July 1, 1895, amount covered by uncompleted contracts	9,000.00
July 1, 1895, balance available	1,009.97
Amount (estimated) required for completion of existing project	98,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	50,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for dredging in Stamford Harbor, Connecticut, opened by Lieut. Col H. M. Robert, Corps of Engineers, at New York City, January 2, 1895.

No.	Name and address of bidder.	East Branch.		West Branch.		Removing rock, per actual working time of dredge, per hour.	Total.
		Per cubic yard.	Basis of 300 cubic yards.	Per cubic yard.	Basis of 300 cubic yards.		
		Cents.		*Cents.*			
1	Alonzo E. Smith, Islip, N. Y.	13	$39.00	13	$39.00	$9.00	$87.00
2	Newburg Dredging Co., Newburg, N. Y.	16	48.00	13	39.00	10.00	97.00
3	Elijah Brainard, New York City	11¾	35.25	12½	37.50	8.00	80.75
4	Geo. B. Beardsley, Bridgeport, Conn.	15½	46.50	15½	46.50	12.00	105.00
5	The Hartford Dredging Co., Hartford, Conn.*	12	36.00	9⅝	28.80	8.90	73.70
6	John H. Fenner, Jersey City, N. J.	12¾	38.25	12¾	38.25	10.00	86.50

* Lowest bid. Entered into contract January 14, 1895; work not yet begun.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1894.

Statistics for the West Branch of the harbor have been asked for, but not yet received.

FOR THE EAST BRANCH.

[Through courtesy of Messrs. Getman & Judd, Stamford, Conn.]

Arrivals and departures of vessels.

[Draft, 5 to 15 feet; tonnage, 40 to 542 tons.]

Kind of vessels.	Number of round trips.
Steamers	984
Sailing vessels	118
Barges	193
Total	1,295

Aggregate tonnage of all trips not ascertained.

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Freight received and shipped by water.

Chief articles.	Tons.	Estimated value.
Receipts:		
Coal and wood	38,847	$162,894
Lumber and building materials	12,781	96,058
Miscellaneous (not otherwise included)	71,871	4,927,882
Total receipts	123,499	5,186,634
Shipments, miscellaneous	15,465	1,250,000

No new lines of transportation have been established since July 1, 1894.

The amount of freight reported for the West Branch in 1893 was 61,000 tons. Assuming it to be the same for 1894, the total decrease in tonnage for the harbor from 1893 would be 33,374 tons.

D 15.

IMPROVEMENT OF HARBOR AT COS COB AND MIANUS RIVER, CONNECTICUT.

This harbor is a tidal inlet extending about 2 miles northwardly from Long Island Sound at a point 4 miles east of the New York State line. It has a high-water width of from 800 to 2,000 feet, but the low-water channel is narrow and bounded by mud flats. At low tide there was in 1892, before the improvement of the harbor was begun, a natural depth of 7 feet or more, with width of about 200 feet for the first half mile, the depth above gradually decreasing to almost zero at the head of the harbor.

Mianus is a small settlement at the north end of the inlet. About three-quarters of a mile below the stream is crossed by the drawbridge of the New York, New Haven and Hartford Railroad, which has stations known as Riverside and Cos Cob on the east and west banks, respectively. The commerce of the harbor is practically confined to the supplies of the communities living along its shores. At Cos Cob, above the railroad bridge, is a shipyard, where a considerable number of small boats are repaired and some built. At Riverside, below the bridge, are the houses and docks of the Riverside Yacht Club.

The mean rise of tide is about 7½ feet.

PROJECT FOR IMPROVEMENT.

By act of Congress approved September 19, 1890, a preliminary examination and survey of this harbor were ordered. The report on the survey, dated July 31, 1891, and printed in the Annual Report of the Chief of Engineers for 1891, Part I, page 855, contains a plan and estimate for improvement, to make by dredging a channel of 6 feet depth at mean low water, 150 feet wide up to the railroad bridge, and 100 feet wide thence to Mianus, at cost, as follows:

Dredging 160,000 cubic yards, at 20 cents	$32,000
Contingencies	4,000
Total	36,000

This project was adopted by approval of the Secretary of War dated July 21, 1892, after the first appropriation for the improvement had been made.

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Up to July 1, 1894, 40,000 cubic yards of mud had been dredged, making the channel 150 feet wide and 6 feet deep at mean low water up to the railroad bridge.

A sketch of this harbor was printed in the Annual Report of the Chief of Engineers for 1893, page 958.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

By the river and harbor act of August 17, 1894, $4,000 was appropriated for continuing this improvement, "including a survey of the lower part of the harbor with a view of making a turning basin therein." The survey has been made and the map and report will be presented early in the ensuing year.

After duly advertising for proposals a contract was entered into with George B. Beardsley, under date of January 16, 1895, for dredging about 33,000 cubic yards of material, at 9.3 cents per yard, in order to extend the 6-foot channel above the railroad bridge. Work under this contract has not yet been begun. The contract expires November 30, 1895.

The survey provided for by the river and harbor act of 1894 has been made, and a copy of the report is attached hereto.

PRESENT CONDITION OF IMPROVEMENT.

The channel up to the railroad bridge, dredged 150 feet wide and 6 feet deep at mean low water in 1893, remains in fair condition.

PROPOSED OPERATIONS.

Under the contract now in force the 6-foot channel will be extended about 2,000 feet above the railroad bridge with width of 100 feet.

With future appropriations it is proposed to continue dredging in accordance with the approved project.

Appropriations for improving this harbor have been made as follows:

Application.	Date.	Amount.
Dredging below railroad bridge	July 13, 1892	$7,000
Dredging above railroad bridge	Aug. 17, 1894	4,000
Total		11,000

Cos Cob Harbor and Mianus River are in the collection district of Fairfield, Conn., of which Bridgeport is the port of entry. The nearest light-house is on Great Captains Island, about 2 miles southwest from the harbor entrance. Fort Schuyler, Throgs Neck, New York, 18 miles to the southwest, is the nearest work of defense.

Money statement.

July 1, 1894, balance unexpended	$417.53
Amount appropriated by act of August 17, 1894	4,000.00
	4,417.53
June 30, 1895, amount expended during fiscal year	389.60
July 1, 1895, balance unexpended	4,027.93
July 1, 1895, amount covered by uncompleted contracts	3,069.00
July 1, 1895, balance available	958.93
Amount (estimated) required for completion of existing project	25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	20,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

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Abstract of proposals for dredging in Cos Cob Harbor and Mianus River, Connecticut, opened by Lieut. Col. H. M. Robert, Corps of Engineers, at New York City, January 3, 1895.

[Amount available, $3,000.]

No.	Name and address of bidder.	Price per cubic yard, scow measurement.	Number of cubic yards based on price bid
		Cents.	
1	Alonzo E. Smith, Islip, N. Y.	13	23,077
2	John H. Fenner, Jersey City, N. J.	11½	25,037
3	George B. Beardsley, Bridgeport, Conn.*	9 3/16	32,358
4	Elijah Brainard, 24 State street, New York City	14	21,429

* Lowest bid. Contract entered into January 16, 1895; work not yet begun.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1894.

[Through courtesy of Mr. Frederick Beltz, of Riverside, Conn.]

Arrivals and departures of vessels.

[Draft 4 to 8 feet; tonnage 25 to 100 tons.]

Kind of vessels.	Number of different vessels.	Number of round trips.	Aggregate tonnage of all trips.
Steamers	6	90	2,400
Sailing vessels	60	240	48,000
Barges	2	12	1,200
Total	68	342	51,600

Freight received and shipped by water.

Chief articles.	Tons.	Estimated value.
Receipts:		
Coal, timber, oysters, shipbuilding materials, hardware, and general merchandise	11,100	$57,500
Shipments:		
Ice, car sweepers, oysters and fish, and farm products	40,500	245,500
Total	51,600	303,000

No statistics were received last year, and the increase or decrease of commerce can not be determined.

Vessels repaired in 1894, 42—from 5 to 50 tons each.

One new line of transportation (by schooner) has been established since July 1, 1894.

Two new mills—a woolen mill and a sawmill—were erected in 1894.

"The shipyards will double the work if dredging is completed. The harbor is the safest between City Island and New London; not a vessel was injured in the great gale of 1893, when vessels were lost in every other harbor on Long Island Sound.

"The Riverside Yacht Club has 80 yachts in its fleet, most of which anchor in the harbor."

D 16.

IMPROVEMENT OF PORT CHESTER HARBOR, NEW YORK.

This harbor consists of the lower part of the Byram River and a bay at its mouth opening into Long Island Sound. The river for about 1½ miles from its mouth forms the boundary line between the States of

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New York and Connecticut. It was formerly navigable to within a few hundred feet of the bridge at Port Chester, a little more than a mile above the mouth.

Before improvement the available depth up to the wharves was about 1 foot at mean low water.

The mean rise of tide is 7.4 feet.

PROJECTS FOR IMPROVEMENT.

A survey of the harbor was made in 1871, and a project for improvement based on it was submitted and adopted. The project provided for the removal of two rocks, Sunken Rock, at the entrance to the bay, with 5.7 feet low-water depth, to be removed to 11 feet, and Salt Rock, about 1,000 feet above the mouth of the river, partly bare at low water, to be removed to 9 feet depth; it also provided for a breakwater 400 feet long at Byram Point. The estimated cost was as follows:

Sunken Rock, 1,474.5 cubic yards, at $40	$58,980
Salt Rock, 316.3 cubic yards, at $40	12,652
Breakwater at Byram Point	25,000
Total	96,632

Under this project Salt Rock was removed in 1873. No further work was done until 1884, when a survey of the channel was made under the appropriation of August 2, 1882, and a project for expending the funds available in 1884 (about $16,000) was submitted and approved. It provided for making a channel from 60 to 100 feet wide and 2½ feet deep at mean low water from the bay to the vicinity of the bridge at Port Chester. The channel was completed to within 150 feet of the bridge in May, 1885. In 1886, 9,232 cubic yards of sand and gravel were dredged, straightening the channel and removing small lumps and irregularities.

Under the appropriation of $5,000, made in 1888, the project was modified to omit the removal of Sunken Rock and to change the location of the proposed breakwater, making it extend from Sunken Rock toward the shore. Sunken Rock was dangerous only because it was submerged, and was at the side of the channel; the channel width at the rock was ample. A breakwater, with the end on the rock rising some distance above high water, would serve as a beacon, and would be an aid instead of a danger to navigation, besides affording more shelter than the originally proposed breakwater; thus it would take the place both of the breakwater and the removal of Sunken Rock, together estimated to cost $83,980. On account of this modification, in the Annual Report of the Chief of Engineers for 1890, the estimated cost for completion of project was reduced from $64,632 to $25,000.

Up to July 1, 1894, Salt Rock had been removed, a channel 2½ feet deep at mean low water had been dredged up to the Port Chester Highway Bridge, and the breakwater between Byram Point and Sunken Rock had been built to a length of 783 feet, but not to full cross section.

A sketch of Port Chester Harbor from Salt Rock to Long Island Sound was printed in the Annual Report of the Chief of Engineers for 1889, page 716.

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OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

The river and harbor act of 1894 appropriated $5,000 for continuing this improvement.

After advertising for proposals, the bid of Mr. John Voorhis was accepted to furnish and place riprap granite to complete the end of the breakwater, at the rate of 99 cents per ton. Work was begun November 5 and completed December 8, 1894, 713 tons of granite being placed at the end of the breakwater, buildiug it up to 15 feet above mean low water, to serve as a beacon over the rock and as support for a range light, if that is found necessary.

A contract for dredging was also entered into (after duly advertising) with Alonzo E. Smith, under date of November 17, 1894, to remove about 38,000 cubic yards of material, at the rate of 10 cents per yard for work below Town Dock and 15 cents per yard for work above that point. Dredging was begun November 28 and suspended on account of ice on December 20, 1894, after 2,057 cubic yards of mud had been removed. The material was a moderately stiff mud, very easy to dredge, but the contractor found it impossible to dump it through his scows, and for the most part had to shovel it out by hand. At his request, and with approval of the Chief of Engineers, the contract has been extended to November 1, 1895, and the contractor proposes to find some practicable method of completing the work by that date.

PRESENT CONDITION OF IMPROVEMENT.

Salt Rock has been removed to a depth of 9 feet below mean low water. The breakwater has been built from Sunken Rock to high-water mark on the rocks at Byram Point, leaving a gap 30 feet wide near the shore end to allow small boats to pass through at high tide. The end of the breakwater has been built up to 15 feet above low water, to serve as a beacon upon Sunken Rock.

An available channel of 2½ feet depth at mean low water has been dredged to a point 150 feet below the bridge; thence to the bridge the width is 25 feet. In front of the wharves, where vessels lie aground at low tide, the bottom has been leveled as nearly as practicable.

PROPOSED OPERATIONS.

The remainder of the last appropriation will be applied to deepening the channel, under an existing contract.

With future appropriations it is proposed to maintain the work already done and to enlarge the river channel.

Appropriations for improving Port Chester Harbor, New York, have been made as follows:

Application.	Date.	Amount.
Removing Salt Rock	June 10, 1872	$12,000
Dredging in Byram river and bay	Aug. 2, 1882	15,000
Breakwater	Aug. 11, 1888	5,000
Do	Sept. 19, 1890	5,000
Do	July 13, 1892	5,000
Breakwater and dredging	Aug. 17, 1894	5,000
Total		47,000

Port Chester Harbor is in the collection district of New York. The nearest lighthouse is on Great Captains Island, 1¾ miles east of the mouth of the harbor. The nearest work of defense is Fort Schuyler, Throgs Neck, about 15 miles southwest.

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Money statement.

July 1, 1894, balance unexpended		$224.26
Amount appropriated by act of August 17, 1894		5,000.00
		5,224.26
June 30, 1895, amount expended during fiscal year		1,291.44
July 1, 1895, balance unexpended		3,932.82
July 1, 1895, outstanding liabilities	$33.17	
July 1, 1895, amount covered by uncompleted contracts	3,813.47	
		3,846.64
July 1, 1895, balance available		86.18
Amount (estimated) required for completion of existing project		10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals for furnishing and placing stone in the breakwater at Byram Point, Port Chester Harbor, New York, opened by Lieut. Col. H. M. Robert, Corps of Engineers, at New York City, October 31, 1895.

No.	Name and address of bidder.	Rate per ton (500 tons).	Amount of bid.
1	Thos. Ritch & Son, 616 East Seventeenth street, New York City	$1.25	$625
2	S. & E. S. Belden, Hartford, Conn.	1.19	595
3	John Voorhis, Greenwich, Conn.*	.99	495
4	John A. Bouker, 110 Wall street, New York City	1.25	625

* Lowest bid; accepted. Work completed December 8, 1894.

Abstract of proposals for dredging in Port Chester Harbor, New York, opened by Lieut. Col. H. M. Robert, Corps of Engineers, at New York City, November 5, 1894.

[Amount available for work, $3,333.33; $666.67.]

No.	Name and address of bidder.	Below town dock.		Above town dock.		Total number of cubic yards.
		Price per cubic yard.	Cubic yards based on price bid.	Price per cubic yard.	Cubic yards based on price bid.	
		Cents.		Cents.		
1	The Hartford Dredging Co., Hartford, Conn.	14 3/10	23,310	17 3/10	3,853	27,163
2	Morris F. Brainard, New York City	10 1/4	31,746	12 1/4	5,299	36,975
3	J. H. Fenner, Jersey City, N. J.	11 1/2	28,985	12 1/2	5,333	34,318
4	Alonzo E. Smith, Islip, N. Y.*	10	33,333	15	4,444	37,777

* Lowest bid; recommended. Entered into contract November 17, 1894; work suspended and contract extended to November 1, 1895.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1894.

These have been asked for, but have not yet been received. The total tonnage of freights reported for the calendar year 1893 was 163,000.

D 17.

IMPROVEMENT OF LARCHMONT HARBOR, NEW YORK.

Larchmont Harbor is a bay on the northwest shore of Long Island Sound, about 25 miles by water from the Battery, New York City, and 6 miles southwest from the boundary between the States of New York

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and Connecticut. The harbor is about a half mile wide and extends rather more than half a mile inland; it is a basin with no definite channel, the low-water depth of 18 feet at the entrance gradually decreasing toward the shores, east, north, and west.

The harbor is chiefly used by the Larchmont Yacht Club, but is more or less sought by small coasters and fishing vessels for refuge or for night anchorage. It is exposed to storms from east to south, and during northeast storms heavy seas roll around Long Beach Point, east of the harbor, and compel vessels to go well up into shoal water for shelter.

The entrance is divided into three channels by two rocks: Umbrella Rock, about 800 feet from the west shore, being a large ledge with least depth of 3.1 feet at mean low water, and Huron Rock, about 900 feet southwest from the east shore, a smaller ledge with least depth of 9.8 feet. The channel between the rocks is over 900 feet wide and is the one almost invariably used. There are other rocks inside the harbor which are well known and are marked by spindles; they are too near the west shore to interfere with the use of the harbor for general navigation.

The mean rise of the tide is 7.4 feet.

PROJECTS FOR IMPROVEMENT.

The river and harbor act of August 11, 1888, provided for a survey of Larchmont Harbor, which was made the following year. The report on the survey, dated November 26, 1889, was printed as House Ex. Doc. No. 40, Fifty-first Congress, first session, and also in the Annual Report of the Chief of Engineers for 1890, Part I, page 675. With the report were presented two alternative projects for improvement, one for removal of Umbrella and Huron rocks, the other for breakwaters to cover each rock and extend to the nearest shore. The cost of removing the rocks to 15 feet depth at mean low water was estimated at $126,000 and the cost of the two breakwaters at $105,000. At the date of the report the preference of those most interested in the harbor was expressed in favor of removing the rocks; after further consideration they changed their views, preferring the breakwaters, and, in accordance with their petition or request, a clause in the first draft of the river and harbor act of 1890 which required that the money appropriated for the harbor be expended "to remove obstructions at mouth of harbor" was struck out.

The project for constructing two breakwaters at the mouth of the harbor was approved by the Secretary of War September 27, 1890, after the first appropriation for improving the harbor was made.

Up to July 1, 1894, 74 linear feet of Umbrella Breakwater and 64 linear feet of Huron Breakwater had been built.

A sketch of Larchmont Harbor was printed in House Ex. Doc. No. 40, Fifty-first Congress, first session, in connection with the report upon the survey, but no sketch of the harbor has been printed with any annual report of the Chief of Engineers.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

Nothing was done.

PRESENT CONDITION OF IMPROVEMENT.

The only public work done in this harbor is the beginning of construction of two breakwaters. Umbrella Breakwater has been made 74 feet long and Huron Breakwater 64 feet long. Both were begun

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upon the rocks, and were built to 10 feet above low water, with top width of 4 feet, the outer ends being slightly higher to serve as beacons on the rocks. At their present lengths they serve no other purpose than to mark the rocks.

PROPOSED OPERATIONS.

Future appropriations should be applied to completing both breakwaters, as provided for in the project.

The only appropriation for improving Larchmont Harbor, New York, is the one of $5,000 made by the act of Congress approved September 19, 1890.

Larchmont Harbor is in the collection district of New York. The nearest lighthouse is on Execution Rock, 3 miles southward. Fort Schuyler, about 8 miles southwest, is the nearest work of defense.

Money statement.

July 1, 1894, balance unexpended	$120.95
July 1, 1895, balance unexpended	120.95
Amount (estimated) required for completion of existing project	100,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893	

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1894.

These have been asked for, but not yet received.

D 18.

IMPROVEMENT OF EAST CHESTER CREEK, NEW YORK.

East Chester Creek, called also Hutchinson River, is a small stream which, as a tidal inlet for the last 4 miles of its course, traverses marshes of one-fourth to 1 mile in width, and empties into East Chester or Pelham Bay, a large bay on the northwest shore of Long Island Sound, just east of Throgs Neck, and 20 miles by water from the Battery, New York City. The width of the creek varies from 25 feet to half a mile, at high water, but the channel is narrow everywhere.

Pelham Bridge, a highway bridge, crosses the creek near its mouth. A short distance above is the bridge and trestle of the Harlem River Branch of the New York, New Haven and Hartford Railroad, and at Lockwoods, about 2¼ miles above its mouth, the stream is crossed by the Boston road. All three bridges are drawbridges.

The mean rise of tide at the mouth of the creek is 7.1 feet.

For half a mile up the creek there was originally a channel from 4 to 9 feet deep at low water, but the depth decreased farther up, and at Town Dock, the principal landing, about 1½ miles from the mouth, the available depth at high water was only about equal to the rise of the tide. Above Town Dock the stream was narrow and crooked, and the depth about the same as just below.

The commerce at Town Dock was principally in coal and building materials for East Chester and Mount Vernon. The latter is a rapidly growing place, with a present population of about 20,000. The main business part of the city of Mount Vernon is about 2 miles from Town

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Dock. It is understood to be mainly for the benefit of prospective Mount Vernon commerce that the improvement of East Chester Creek is desired.

PROJECTS FOR IMPROVEMENT.

In 1871 a survey of East Chester Creek was ordered by Congress. It was made the same year, and in the report, dated January 19, 1872, and printed in the Annual Report of the Chief of Engineers for 1872, page 812, three plans of improvement were outlined, viz:

For making and maintaining, by means of a tidal basin and a system of dikes, a channel 9 feet deep at mean low water, estimated to cost $1,646,000.

For making and maintaining in the same way a channel 11 feet deep at mean high water (about 4 feet at low water), estimated to cost $731,000.

For securing 7 feet depth at slack-water navigation by means of a lock above Goose Island (about half a mile from the mouth of the creek), estimated to cost $300,000.

No recommendation as to the worthiness of improvement accompanied these estimates. March 25, 1872, the House of Representatives passed a resolution inquiring the cost of removing obstructions between Tide Gauges No. 1 and No. 2, so as "to afford the same depth of water above Station No. 1 as now prevails below it."

In reply to this resolution a report was submitted April 3 1872 (see Annual Report of the Chief of Engineers for 1872, p. 814), containing the following estimates:

Basin, purchase of site, 18 acres, at $150	$2,700
Excavation to level of mean low water, 200,000 cubic yards, at 40 cents	80,000
Excavation of cut, 60,000 cubic yards, at 40 cents	24,000
Diking and revetting banks of cut	12,000
Engineering and contingencies	17,805
Total	136,505

This plan contemplated (as appears from maps on file) straightening the channel at Lockwoods and, as it was necessary in any case to replace the old arch bridge of the Boston road by a draw bridge, changing the location of such bridge to a point about 700 feet eastward, so as to give a straighter and cheaper channel for the stream.

In 1873 $25,000 was appropriated for improving East Chester Creek. It was designed to expend it in accordance with the above estimates, which were then considered an adopted project, but no means had been provided for acquiring the land needed for the proposed cut at Lockwoods, so no work was done at that time.

In 1875 it became apparent that the proposed change of location of the drawbridge at Lockwoods could not be made. The old bridge lay on the boundary between the towns of East Chester and Pelham, and was supported by the towns jointly. Under the proposed change of location the new bridge would lie within the town of Pelham, which town would then have to support it; therefore the town of Pelham would not consent to the change, and the old bridge was replaced by an iron drawbridge in the same location. The proposed location of the cut had, therefore, to be altered to bring it to the drawbridge. This necessitated excavating a considerable amount of rock, at an increased cost of $10,000. (See General Newton's letter to the Chief of Engineers, September 24, 1875.)

In 1875 $12,000 more was appropriated for this improvement, but it was not until 1877 that a commission appointed by the State of New

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York finally obtained the land for the proposed cut. After this right of way was secured, in 1877, a contract was entered into for making a cut 9 feet deep at mean high water (2 feet at low water), with a width of 100 feet at high-water level. This contract included about 3,149 cubic yards of rock excavation, 1,210 linear feet of pile dike, and 140 linear feet of crib dike. It was completed in 1878, and in that year and in 1879, under an appropriation of $10,000 made June 18, 1878, dredging was done by hired labor, removing a shoal of bowlders just outside of Pelham Bridge and making a channel about 125 feet wide and 9 feet deep at high water on the west side of Goose Island, being an extension of the original project.

In 1879 $3,500 was appropriated for continuing this improvement, and $3,500 in 1880. These appropriations were not expended until 1884.

In the Annual Report for 1889 it was stated as necessary to complete the improvement from Pelham Bridge to Lockwoods "to construct dikes from the lower end of the cut to Goose Island, a distance of 5,800 feet." In 1880 these dikes were estimated to cost $40,000.

The appropriations were not large enough to warrant beginning the cut above Lockwoods or the above-mentioned dikes, and these proposed works were apparently abandoned for the time being. In 1881 General Newton, U. S. Engineers, then in charge, reported that—

> Furthermore, until it is proved that a depth of 9 or 10 feet * * * can not be maintained under the scale of improvement already completed, it will be unnecessary to inaugurate new works. The amount of funds available, $7,372.14, will be quite sufficient for the present wants of the case.

This money was expended in 1884 in dredging just below Town Dock, a work not included in the original estimate.

August 5, 1886, $10,000 was appropriated for this improvement, which was mostly expended in 1888 and 1889 in dredging between Town Dock and Lockwoods to remove shoals from the previously dredged channel.

In 1887 an estimate was made of the cost of the several proposed extensions of project, from which it appears that $84,000 had been either expended or estimated for works not included in the first estimate, and that estimate, therefore, should be increased to $221,000 if it is proposed to carry out the original plan with these extensions.

It was proposed to expend the appropriation of $5,000 made August 11, 1888, in dredging a cut above Lockwoods, and in January, 1889, the line of cut was staked out and a description given to the Stage commissioners for securing right of way. They were asked to obtain permission to deposit the material on the marsh lands adjacent to the cut, which could be done cheaply as compared with the cost of carrying it out into Long Island Sound. The commissioners reported that this consent could not be obtained, and as the available funds were not sufficient to begin work under any other plan for disposing of dredged materials, work was postponed until larger appropriations should be made.

In 1891 revised estimates for completion were submitted (Annual Report of the Chief of Engineers for 1891, p. 809), omitting the projected diking below Lockwoods, which seemed probably unnecessary, and reducing the estimated cost by $97,000. The existing project, as it now stands, is therefore to make and maintain a channel 100 feet wide and 9 feet deep at mean high water (about 2 feet at low water), extending from Pelham Bay up the creek 3,000 feet above Lockwoods and in removing rocky obstructions from the mouth of the creek, at an estimated cost from the beginning of $124,000.

In 1892, owing to certain changes of ownership, it was found that the requisite permission to deposit dredgings upon the banks of the creek,

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which was refused in 1888, could then be obtained, and work was resumed with the funds then available.

Up to July 1, 1894, the rocky obstructions at the mouth of the creek had been removed and the channel had been made 9 feet deep at mean high water and 100 feet wide up to the highway bridge at Lockwoods, and extended 1,300 feet above Lockwoods with 60 feet width. Between Town Dock and Lockwoods the channel had shoaled at the sides and the available width was from 50 to 75 feet.

A sketch of East Chester Creek was printed in the Annual Report of the Chief of Engineers for 1893, page 968.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

The river and harbor act of August 17, 1894, appropriated $12,000 for continuing this improvement, which it was decided to apply to extension of the cut above Lockwoods.

After due advertisement, proposals for dredging were received and opened October 16, 1894. The specifications for this work contained certain restrictions as to the deposit of material upon the banks, which were insisted upon by the owners, although they were cautioned that any limitations would probably have the effect of increasing the cost of the work. This proved to be the result, and, with the approval of the Chief of Engineers, all the proposals were rejected. The restrictions as to deposits were thereupon all removed and the work was readvertised, and November 12, 1894, a contract was entered into with James McSpirit to do the required dredging at 34 cents per cubic yard, scow measurement, for removing shoals near the bridge at Lockwoods and at 12 cents per cubic yard, prism measurement, for widening and extending the channel. Work under this contract was begun November 16, 1894, and up to the close of the year 2,515 cubic yards, scow measurement, had been dredged, removing a shoal near the highway bridge, and 64,558 cubic yards, prism measurement, had been dredged, widening the previous channel to 100 feet and extending it with full width to the upper limit of the project, with exception of a small area about 105 by 50 feet yet to be dredged.

During the year also three large bowlders and several small stones were removed from the channel just below Lockwoods at a total cost of $49.

PRESENT CONDITION OF IMPROVEMENT.

There is now a channel of 9 feet depth at mean high water (2 feet at mean low water) from Long Island Sound to a point 3,000 feet above Lockwoods. The width is 100 feet or over, except between Town Dock and Lockwoods, a distance of about half a mile, where there has been very considerable shoaling on the sides of the cut, and except a few small shoals which have formed in the upper part of the channel.

The dikes on the east side of the channel below Lockwoods begin to show signs of deterioration, but there is no pressing need of repairs.

PROPOSED OPERATIONS.

Under the existing contract the channel above Lockwoods will be completed.

Future appropriations will be applied to completing and maintaining the entire channel.

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Appropriations for improving East Chester Creek have been made as follows:

Application.	Date.	Amount.
Cutting through marsh and rock, and diking (in 1877)	Mar. 3, 1873	$25,000
Dredging under Boston Road Bridge and at Goose Island	Mar. 3, 1875	12,000
Dredging near Lockwoods, Goose Island, and Pelham Bridge	June 18, 1878	10,000
Dredging, from 40 to 90 feet wide, from Pell Point to Town Dock	Mar. 3, 1879 June 14, 1880	3,500 3,500
Dredging above Town Dock	Aug. 5, 1886	10,000
Dredging above Lockwoods	Aug. 11, 1888	5,000
Do	Aug. 17, 1894	12,000
Total		81,000

East Chester Creek is in the collection district of New York. The nearest lighthouse is on the "Stepping Stones," 3 miles southeast of the mouth of the creek. The nearest work of defense is Fort Schuyler, Throgs Neck, about 3½ miles south.

Money statement.

Amount appropriated by act of August 17, 1894		$12,000.00
June 30, 1895, amount expended during fiscal year		7,229.86
July 1, 1895, balance unexpended		4,770.14
July 1, 1895, outstanding liabilities	$3,700.98	
July 1, 1895, amount covered by uncompleted contracts	653.04	
		4,354.02
July 1, 1895, balance available		416.12
Amount (estimated) required for completion of existing project		43,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		43,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals for dredging in East Chester Creek, New York, opened by Lieut. Col. H. M. Robert, Corps of Engineers, at New York City, October 16, 1894.

[Amount available, $562.50; $8,437.50.]

No.	Name and address of bidder.	Removing shoals.		Deepening channel.		
		Price per cubic yard.	Cubic yards based on price bid.	Price per cubic yard.	Cubic yards based on price bid.	
					Prism measurement.	Scow measurement.
		Cents.		Cents.		
2	Robert E. Brown, Ronkonkoma, N. Y.	30	1,875	31	27,218	32,662
5	Jas. McSpirit, Jersey City, N. J.	33	1,607	24½	.....	34,439
7	Alonzo E. Smith, Islip, N. Y.	40	1,406	24½	34,439	41,327

Bids rejected as excessive.

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Abstract of proposals for dredging in East Chester Creek, New York, opened by Lieut. Col. H. M. Robert, Corps of Engineers, at New York City, November 2, 1894.

[Amount available, $562.50, $8,437.50.]

No.	Name and address of bidder.	Removing shoals.		Deepening channel	
		Price per cubic yard.	Amount to be dredged.	Price per cubic yard.	Amount to be dredged.
		Cents.		*Cents.*	
1	Robert E. Brown, Ronkonkoma, N. Y.	35½	1,592	21⅜	39,474
2	J. H. Fenner, Jersey City, N. J.	29	1,940	23	36,685
3	Jas. McSpirit, Jersey City, N. J.*	34	1,654	12	70,312
4	Alonzo E. Smith, Islip, N. Y.	35	1,607	12	70,312

*Lowest bid; recommended. Entered into contract November 12, 1894; work now in progress.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1894.

[Through courtesy of Col. John E. Bryant, Mount Vernon, N. Y.]

Arrivals and departures of vessels.

[Draft, 5 to 8 feet; tonnage, 125 to 330 tons.]

Kind of vessels.	Number of round trips.	Aggregate tonnage of all trips.
Steamers	478	.....
Sailing vessels	23	210,300
Barges	311	.....
Total	812	210,300

Freight received and shipped by water.

Chief articles.	Tons.	Estimated value.
Receipts:		
Lumber	3,240	$64,800
Building material	22,490	115,500
Coal	11,500	56,500
Miscellaneous (not otherwise included)	96,229	481,145
Total receipts	133,459	717,945
Shipments:		
Miscellaneous	3,809	30,500
Total receipts and shipments	137,268	748,445

The above figures show an increase of tonnage over that reported for 1893 of 77,469 tons.

No new lines of transportation have been established since July 1, 1894.

The commerce increased during the year 1894, owing to the improvement made by the United States Government and by private parties, but the increase would have been much greater if the depth of water were greater. We need at least 15 feet at mean high water and we now have only about 8 feet. With 15 feet of water at mean high tide, vessels loaded with lumber could come from the south and east to our docks, and this trade would greatly increase; indeed, the commerce would increase in all lines of trade.

The freight steamer has made regular triweekly trips between New York and Mount Vernon and has been very successful. With the continued improvements of the river, as needed, other lines will be established and the business will very greatly increase. It is impossible to estimate how much the increase will be, but it is certain that it will be very great.

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By a recent act of the legislature of this State, the northern boundary of New York City has been extended so as to include Hutchinson River (Eastchester Creek) from the Sound to a point about 1,200 feet above Lockwood's Bridge, so that the improvements made and to be made are entirely through New York City and the city of Mount Vernon. The population of this section is rapidly increasing, and its annexation to New York City will certainly very greatly stimulate this increase of population. This waterway is therefore the means of communication for 20 miles from the business part of New York, through the very heart of the city, to a suburban city on its northern border, now having a population of nearly 20,000, which in ten years will undoubtedly increase to 50,000. Under these circumstances the importance of the continued improvement of this waterway will be apparent.

J. E. BRYANT.

MOUNT VERNON, *June 1, 1895.*

D 19.

IMPROVEMENT OF GREENPORT HARBOR, NEW YORK.

This harbor is a roadstead near the east end of the north fork of Long Island, lying between the north fork on the northwest and north, and Shelter Island on the southeast and south. The anchorage ground was exposed to storms from northeast and east.

A sand spit, called Joshua Point, formerly protected the little bay at Greenport from easterly storms, but in a few years prior to 1883 this had worn away rapidly and the sand had been carried into the bay.

The mean rise of tide is 2.4 feet.

PROJECTS FOR IMPROVEMENT.

The river and harbor act of 1881 ordered a survey of this harbor, the report upon which, dated January 20, 1882, and printed in the Annual Report of the Chief of Engineers for 1882, Part I, page 635, contained plans and estimates for a breakwater (extending to the curve of 18 feet depth) to be built to 3 feet above mean high-water level, with a top width of 5 feet and side slopes of 1 upon 1; the estimated cost was $46,000. The first appropriation for the harbor was made by act of Congress of August 2, 1882, and thereupon the project was adopted as above. In 1890 the project was modified to provide for building up the breakwater to a height of 5 feet above mean high water, to extend it no farther (it was then 1,570 feet long), and to apply the remainder of the estimate for completion of improvement to dredging in the anchorage afforded by the breakwater.

Up to July 1, 1894, the breakwater had been built to the required dimensions and 55,261 cubic yards of sand had been dredged, enlarging the area of sheltered anchorage inside the breakwater by 5 acres, and making a channel 60 feet wide and 8 feet deep at mean low water through the entrance to Sterling Basin, a land-locked cove much used for winter anchorage for yachts and small vessels. The project was completed in 1893.

Harbor lines were established in Greenport Harbor by the Secretary of War January 5, 1894.

A sketch of Greenport Harbor was printed in the Annual Report of the Chief of Engineers for 1893, page 970.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

Nothing was done.

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PRESENT CONDITION OF IMPROVEMENT.

The breakwater is 1,570 feet long, 5 feet wide on top, the top being 5 feet above high water; it contains 19,310 tons of riprap.

The available anchorage of 9 feet depth inside the breakwater has been increased by 5 acres of completely sheltered area. The channel between Sterling Basin and the outer harbor has been made 60 feet wide and 8 feet deep at mean low water, but it has presumably shoaled somewhat since it was dredged in 1893.

PROPOSED OPERATIONS.

The amount of the original estimate for this improvement has been appropriated and expended and the projected improvement has been completed. Nothing further is now contemplated.

Appropriations for improving Greenport Harbor have been made as follows:

Application.	Date.	Amount.
Survey	Mar. 3, 1881	$5
Expended on breakwater	Aug. 2, 1882	10
Do	July 5, 1884	10
Do	Aug. 5, 1886	5
Do	Aug. 11, 1888	5
Breakwater and dredging	Sept. 19, 1890	5
Dredging	July 13, 1892	11
Total		46

Greenport is a port of delivery in the collection district of Sag Harbor. The nearest light-house is on Long Beach Point, 3 miles to the eastward. The nearest work of defense is Fort Trumbull, New London Harbor, Connecticut, 21 miles distant in a straight line.

Money statement.

July 1, 1894, balance unexpended	$1,295.7
June 30, 1895, amount expended during fiscal year	11.5
July 1, 1895, balance unexpended	1,284.2

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1894.

[Through courtesy of S. Truman Preston, Greenport, N. Y.]

Arrivals and departures of vessels.

[Draft, 2 to 15 feet; tonnage, 5 to 1,364 tons.]

Kind of vessels.	Number of vessels.	Number of round trips.
Steamers	67	2,44
Sailing vessels	241	
Yachts	720	
Barges	14	
Total	1,042	

Aggregate tonnage of all trips not ascertained.

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Freight received and shipped by water.

Chief articles.	Tons.
Receipts:	
Coal	14,500
Fish and fertilizers	104,500
Miscellaneous (not otherwise included)	28,492
Total receipts	147,492
Shipments:	
Brick	3,000
Miscellaneous (not otherwise included)	19,336
Total shipments	22,336

The value of these freights is not ascertained.

Number of vessels built during 1894, 31 small boats from 20 to 35 feet long.

Number of vessels repaired during 1894, 423.

Since July 1, 1894, a new line of transportation is reported as established between Greenport and Riverhead, N. Y.

The above statement shows a total amount of freight carried during 1894 of 169,828 tons, which is greater than that reported for 1893 by 11,518 tons.

D 20.

IMPROVEMENT OF PORT JEFFERSON HARBOR, NEW YORK.

Port Jefferson Harbor is on the north shore of Long Island and about 50 miles east from New York City. It is a mile long and averages three-fourths of a mile wide, and a large part of the area has a depth of 18 feet or more at low tide. Tributary to this harbor on the west are Setauket Harbor and Conscience Bay, two shallow tidal basins. Port Jefferson Harbor is surrounded on three sides by hills, and is separated from Long Island Sound on the north by a beach of sand and gravel, through which, and nearly in the axis of the harbor, is a single entrance 400 feet wide. This entrance is Port Jefferson Inlet, and through it a tidal reservoir of 2 square miles area receives and discharges some 300,000,000 cubic feet of water with every tide, producing a current whose maximum velocity exceeds 4 miles per hour. In the narrow part of the inlet the depths have always been considerable, but a short distance out into the Sound was a broad, flat bar, which originally had a depth of 4 feet at low water. Until the beginning of Government improvement in 1871 the location of the inlet had been shifting; since 1838 it had moved westward 790 feet, an average annual rate of 24 feet.

The village of Port Jefferson, with a population of about 3,000, lies at the head or south end of the harbor. The mean rise of tides at the village wharves is 6.2 feet; in Long Island Sound, outside the inlet, it is 7 feet. The difference is wholly in the low-water levels.

PROJECT FOR IMPROVEMENT.

A survey of the harbor was made in 1853 by Lieutenant Harrison, U. S. Engineers. In 1870 an examination was ordered by Congress. The first project for improvement was submitted by General Warren, January 16, 1871, after an examination, and provided for building a jetty on the east side of the entrance, extending out to the 9-foot curve and rising to 11 feet above mean low water, to be built partly of dimension stone; also for dredging a channel 200 feet wide and 7 feet deep at

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mean low water through the bar. (See Annual Report of the Chief of Engineers for 1871, p. 805.) The estimated cost was as follows:

Construction of jetty	$150,125
Dredging	15,000
Total	165,125

When the project was adopted under the appropriation of March 3, 1871, it was provided that the jetty should be of riprap, rising only to the level of mean high water, except between the high and low water marks on the beach, where it was to be carried to the level of the highest tides, but no change was made in the estimates. Under this appropriation 600 feet of the jetty were built, and under the appropriation of June 10, 1872, it was extended to 1,052 feet. An estimate made in 1873 of the cost of completion ($35,000) made the estimate for the whole project $65,000. In 1875 a modification of the project, based on the observed effect of the jetty, was made, providing for a jetty on the west side of the entrance about 1,075 feet long and rising 4 feet above mean high water, designed to increase the force of the tidal currents. The width of the proposed channel was also reduced to 100 feet. No new estimate was submitted at the time, but in 1877, after about $8,000 had been expended on the west jetty, it was estimated that $12,250 would be required to complete it, or $20,250 in all. A revised estimate, made in the same year for the whole improvement, contemplated extending the east jetty to the 9-foot curve, extending the west jetty 600 feet farther, and dredging a channel 100 feet wide and 8 feet deep (this increase of depth on account of increased draft of vessels using the harbor), at an estimated cost of $34,000. Forty-five thousand dollars had been appropriated and nearly expended, making the total estimate from the beginning $79,000 (including $6,000 appropriated in 1876 and then unexpended). This estimate was incorrectly reported in 1878, but was reverted to in 1879 and repeated in each subsequent annual report. In 1877 one cut 25 feet wide and 8 feet deep was dredged through the bar. The channel was dredged to a width of 100 feet under the appropriation of March 3, 1879. In 1877 the east jetty was raised to a height of 5 feet above mean high water and extended 50 feet. In 1878 the west jetty was extended 450 feet, but the height was made only 2 feet above mean low water, except the outer end and an intermediate point, which were raised to 4 feet above mean high water, to serve as guides.

Between 1879 and 1883 both jetties were extended and repaired, making their respective lengths 1,390 feet for the east jetty and 940 feet for the west jetty. This completed the then existing project.

By act of Congress of August 11, 1888, an examination of Port Jefferson Inlet was ordered. A preliminary examination was found sufficient, with recent Coast Survey charts, for all required purposes, and, with the report on this examination, dated December 5, 1888, and printed in the Annual Report of the Chief of Engineers for 1889, Part I, page 751, were presented plans and estimates for making and maintaining channels through the inlet of 10 and 12 feet depth respectively.

These estimates were as follows:

For channel 12 feet deep and 200 feet wide:	
Repairing and enlarging east jetty	$34,200
Repairing and enlarging west jetty	18,150
Extending east jetty	35,200
Dredging	43,050
Contingencies, say	14,400
Total	145,000

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For channel 10 feet deep and 200 feet wide:	
Repairing and enlarging east jetty	$34,200
Repairing and enlarging west jetty	18,150
Dredging	25,390
Contingencies, say	12,260
Total	90,000

Commencement of work under the project for 10 feet depth was approved by the Secretary of War November 1, 1890, after an appropriation had been made for "the project to give a channel 10 feet deep and 200 feet wide."

Up to July 1, 1894, the east jetty had been enlarged for its whole length outside of high-water mark, and about 250 feet at the outer end of the west jetty had been built up. The channel through the inlet had been made 240 feet wide and 10 feet deep at mean low water.

The river and harbor act of 1894 appropriated $7,500 for improving the harbor at Port Jefferson Inlet "to be expended in obtaining twelve feet in depth at mean low water in Port Jefferson Inlet and Harbor, in accordance with the plan submitted in Annual Report of the Chief of Engineers for eighteen hundred and eighty-nine." In accordance therewith, and after approval of the Secretary of War, the project for improvement was changed and the plan and estimates for obtaining 12 feet depth at mean low water were adopted as a modification of the previous project for 10 feet depth.

The modified project for this improvement now consists in extending and enlarging the jetties and making the channel 200 feet wide and 12 feet deep at mean low water, at an estimated cost from the beginning, in 1871, of $224,000.

A sketch of Port Jefferson Inlet, the entrance to the harbor, was printed in the Annual Report of the Chief of Engineers for 1886, page 660.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

By act of Congress of August 17, 1894, $7,500 was appropriated for this improvement, to be expended upon the project for a 12-foot channel. After advertising for proposals for dredging, a contract, dated April 17, 1895, was entered into with the Hartford Dredging Company to remove about 27,000 cubic yards of sand from the inlet channel, making a depth of 12 feet at mean low water, the price being 26 cents per cubic yard. Work under this contract has not yet been begun.

PRESENT CONDITION OF IMPROVEMENT.

The east jetty is 1,390 feet long, part of the shore end being covered by drifting sand; it is 6 feet above high-water level and 4 feet wide on top. The west jetty is 940 feet long; the outer 250 feet are built up about 4 feet above high water, with top width of 4 feet; the inner part is about 2 feet above low water. The west jetty requires building up, and both require trimming and filling out the side slopes.

The dredged channel has been made 240 feet wide and 10 feet deep at mean low water through the inlet.

PROPOSED OPERATIONS.

Under the contract now in force it is proposed to dredge a channel through the inlet 12 feet deep at mean low water and about 100 feet wide.

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Future appropriations will be applied to completing the jetties and widening the channel, as provided for in the approved project.

Appropriations for Port Jefferson Harbor have been made as follows:

Application.	Date.	Amount
East jetty	Mar. 3, 1871	$15
Do	June 10, 1872	15
East and west jetties	Mar. 3, 1875	15
East jetty and dredging	Aug. 14, 1876	6
East and west jetties	June 18, 1878	8
Dredging	Mar. 3, 1879	5
East and west jetties	June 14, 1880	3
East jetty	Mar. 3, 1881	4
Do	Aug. 2, 1882	8
Enlarging jetties and dredging	Sept. 19, 1890	25
Dredging, 10 feet deep	July 13, 1892	15
Dredging, 12 feet deep	Aug. 17 1894	7
Total		121

Port Jefferson is a port of delivery in the collection district of New York. There is a light-house on Old Field Point, 1¼ miles west of the harbor entrance. Fort Hale, New Haven Harbor, Connecticut, 23 miles distant, is the nearest work of defense.

Money statement.

July 1, 1894, balance unexpended	$1,199
Amount appropriated by act of August 17, 1894	7,500
	8,699
June 30, 1895, amount expended during fiscal year	41
July 1, 1895, balance unexpended	8,657
July 1, 1895, amount covered by uncompleted contracts	7,020
July 1, 1895, balance available	1,637
Amount (estimated) required for completion of existing project	102,500
Amount that can be profitably expended in fiscal year ending June 30, 1897	35,000
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

Abstract of proposals for dredging in Port Jefferson Harbor, New York, opened by Capt. H. M. Robert, Corps of Engineers, at New York City, April 8, 1895.

[Amount available, $7,000.]

No.	Name and address of bidder.	Price per cubic yard, scow measure.
		Cents.
1	The Hartford Dredging Co., Hartford, Conn.*	2
2	John H. Fenner, 380 Communipaw avenue, Jersey City, N. J.	2
3	R. J. & J. S. Packard, 130 Pearl street, New York City	2
4	F. H. Brainard, 24 State street, New York City	2
6	Newburg Dredging Co., Newburg, N. Y.	3

*Lowest bid; accepted. Contract entered into April 17, 1895; work not yet begun.

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COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1894.

[Through courtesy of J. T. Mather, Port Jefferson, N. Y.]

Arrivals and departures of vessels.

[Draft, 4 to 14 feet; tonnage, 15 to 634 tons.]

Kind of vessels.	Number of round trips.	Aggregate tonnage of all trips.
Steamers	780	52,000
Sailing vessels	750	37,000
Total	1,530	89,000

Freight received and shipped by water.

Chief articles.	Tons.	Estimated value.
Receipts: Building materials, coal, grain, rubber-factory goods, and general merchandise	30,000	$960,000
Shipments: Wood, farm produce, flour, feed, rubber goods, shellfish, etc	12,000	121,000

The above figures show a decrease in tonnage of freight of 4,000 tons since 1893, when 46,000 tons were reported.

No new lines of transportation have been established since July 1, 1894.

Vessels entered harbor for refuge		350
Vessels hauled up for repair (ranging from 15 to 634 tons)		203
Tonnage of vessels hauled up for repair	tons..	12,000
Vessels laid up for winter 1894–95		89
Tonnage of vessels laid up for winter 1894–95	tons..	6,830

D 21.

IMPROVEMENT OF HUNTINGTON HARBOR, NEW YORK.

Huntington Harbor is a landlocked basin about 2 miles long and a quarter of a mile wide, extending in a crooked but generally southerly direction from Huntington Bay, from which it is separated by a beach of sand and gravel, through the western end of which a narrow inlet (about 300 feet wide) connects the harbor and the bay.

The bay is a large, deep harbor of refuge on the north shore of Long Island, about 40 miles east from New York City. The harbor has an available depth of about 8 feet at mean low water through the entrance and more than halfway up, but in the three-quarters of a mile nearest the head or south end of the harbor the original channel was narrow and decreasing in depth to zero at low tide.

Huntington village lies about a mile south at the head of the harbor; it has 4,000 to 5,000 population.

The mean rise of tide is 7.2 feet.

PROJECTS FOR IMPROVEMENT.

By act of Congress approved March 3, 1871, a survey of this harbor was authorized. It was made in that year, and with the report (dated December 11, 1871, and printed in the Annual Report of the Chief of Engineers for 1872, p. 907) was submitted an estimate of $22,780 as the cost of dredging out a shoal at the entrance to the harbor, and of

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extending the 8-foot channel 150 feet wide for about 2,000 feet up to the old wharf, the property of the town.

By act of Congress of June 10, 1872, $22,500 was appropriated for the harbor, and the project for improvement was completed in April, 1873, the outer shoal being removed to 8 feet depth and the 8-foot channel being extended 2,200 feet to the old town wharf; the width of 150 feet was, however, reduced to 130 feet in the last 900 feet length, on account of exhaustion of funds. It had been contemplated to dump most of the dredged material on the flats in the harbor, but on account of much local opposition this was abandoned after about 2,000 yards had been dumped there, and the rest of the dredged material was deposited in deep water in Long Island Sound. The amount dredged was 91,786 cubic yards.

The river and harbor act of July 5, 1884, ordered a survey or examination of this harbor. A survey was made the same year, the report on which (printed in the Annual Report of the Chief of Engineers for 1885, p. 703 et seq.) contains a plan for restoring and maintaining the depth of 8 feet, made by dredging in 1872 and 1873, but subsequently lost by settling of the banks, with estimate of cost for carrying the channel up to the old town dock, as follows:

Dredging 84,000 cubic yards, at 25 cents per cubic yard	$21,000	
Pile protection, 1,400 linear feet, at $5 per linear foot	7,000	
		28,000
Superintendence and contingencies		4,000
Total		32,000

With an estimate of additional cost of $10,000, should it be decided to carry the channel up to the last wharf on the east side, a distance of 800 feet farther.

The beginning of work under this project was approved by the Secretary of War November 3, 1890, after an appropriation for the improvement had been made by Congress, and the project as adopted provided for extending the 8-foot channel with width of about 100 feet up to the old town dock or beyond, and for maintaining it by pile protection, at an estimated cost of $32,000.

Owing to local opposition to the driving of piles in the harbor and thus limiting the high-water channel, the pile protection has been indefinitely deferred, and it is believed that equally satisfactory results can be secured by dredging from time to time to maintain the channel width, at an expense not exceeding that for building and maintaining the piling.

Up to July 1, 1894, the 8-foot channel had been dredged 105 feet wide up to the bend at and near old town wharf, with width of 185 feet at the bend and with 90 feet width above the bend nearly to the upper landing of the harbor. No work has been done on the projected pile protection.

A sketch of the upper part of Huntington Harbor was printed in the Annual Report of the Chief of Engineers for 1893, page 976.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

The river and harbor act of 1894 contained an appropriation of $2,000 for continuing this improvement. After advertising for proposals a contract, dated December 20, 1894, was entered into with J. H. Fenner for dredging about 14,000 cubic yards of material at the rate of 12 cents per cubic yard. Work under this contract has not yet been begun.

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PROPOSED OPERATIONS.

Under the contract now in force the channel will be widened about 25 feet.

Future appropriations will be applied to maintenance of the channel by further dredging or by diking as seems expedient.

Appropriations for improving Huntington Harbor have been made as follows:

Application.	Date.	Amount.
Dredging	June 10, 1872	$22,500
Do	Sept. 19, 1890	10,000
Do	July 13, 1892	5,000
Do	Aug. 17, 1894	2,000
Total		39,500

Huntington Harbor is in the collection district of New York. The nearest lighthouse is on Eatons Point, at the east side of the mouth of Huntington Bay, about 4 miles distant from the harbor. The nearest works of defense are the fortifications at Willets Point, about 20 miles westward.

Money Statement.

July 1, 1894, balance unexpended	$209.99
Amount appropriated by act of August 17, 1894	2,000.00
	2,209.99
June 30, 1895, amount expended during fiscal year	1.50
July 1, 1895, balance unexpended	2,208.49
July 1, 1895, amount covered by uncompleted contracts	1,680.00
July 1, 1895, balance available	528.49
Amount (estimated) required for completion of existing project	15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

Abstract of proposals for dredging in Huntington Harbor, New York, opened by Lieut. Col. H. M. Robert Corps of Engineers, at New York City, December 1, 1894.

[Amount available, $1,700.]

No.	Name and address of bidder.	Price per cubic yard, scow measure.	Cubic yards, based on price bid.
		Cents.	
1	Alonzo E. Smith, Islip, N. Y.	14.5	11,724
2	*J. H. Fenner, Jersey City, N. J.	12	14,167
3	Elijah Brainard, New York City	12.9	13,178
4	Newburg Dredging Co., Newburg, N. Y.	17	19,000

* Lowest bid; accepted. Entered into contract December 20, 1894; work not yet begun.

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COMMERCIAL STATISTICS FOR CALENDAR YEAR 1894.

[Through courtesy of Mr. George M. Tileston, supervisor of town of Huntington, N. Y.]

Arrivals and departures of vessels.

[Draft, 4 to 9 feet; tonnage, 50 to 450 tons.]

Kind of vessels.	Number of round trips.	Aggregate tonnage of all trips.
Steamers	205	82,000
Sailing vessels	460	100,000
Barges	15	8,000
Total	680	190,000

Freight received and shipped by water.

	Tons (estimated).	Estimated value.
Receipts	40,000	$700,000
Shipments	18,000	325,000
Total	58,000	1,025,000

The above figures show an increase in tonnage of freight of 12,000 tons since 1893, when 46,000 tons were reported.

No new lines of transportation have been reported since July 1, 1894.

D 22.

IMPROVEMENT OF GLEN COVE HARBOR, NEW YORK.

Glen Cove Harbor is a small estuary or creek opening into the east side of Hempstead Harbor, Long Island, about 1¾ miles from Long Island Sound and about 27 miles by water from the Battery, New York City. The channel in the creek is about 2 feet deep at mean low water, and a bar at the entrance has a foot less depth. Vessels entering Glen Cove Harbor have to wait for high tide, anchoring in Hempstead Harbor, where they are exposed to storms from the north and northwest. When such storms are heavy it is impossible to tow over the bar, and from this cause vessels have been obliged to remain in the bay for three or four days exposed to heavy seas.

The mean rise of tide in this harbor is 7.7 feet.

PROJECT FOR IMPROVEMENT.

The act of Congress approved August 5, 1886, provided for a survey or examination of Glen Cove Harbor. A preliminary examination was all that was deemed necessary, and upon this, with the assistance of the U. S. Coast Survey charts recently published, a report, with estimates of cost of improvements was presented, dated December 7, 1886, and printed in the Annual Report of the Chief of Engineers for 1887, Part I, page 645.

The plan of improvement described in this report contemplated a breakwater about 2,500 feet long and extending in a general westerly direction from Mosquito Point on the east side of Hempstead Harbor and north of the entrance of Glen Cove Inlet, the breakwater to be

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built of riprap, the top to be 5 feet wide and 3 feet above high water, with side slopes of 1 upon 1, at an estimated cost as follows:

136,000 tons of riprap, at $1.35 per ton	$183,600
Contingencies, 10 per cent	18,360
Total	201,960

This project was adopted in 1888, an appropriation being made by Congress for beginning the work, and the location of the shore end of the breakwater was definitely fixed to be at the northwest corner of the Glen Cove Dock and its course to be west-southwesterly toward Mott Point. In 1895 this project was modified to reduce the projected length of the breakwater to about 2,000 feet, and its estimated cost from beginning to $135,000.

Up to July 1, 1894, 1,076 linear feet of the breakwater had been built, the top being made 3 feet wide and 4 feet above high water.

A sketch of part of Hempstead Harbor, showing Glen Cove Harbor improvement, was printed in the Annual Report of the Chief of Engineers for 1889, page 728.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

The river and harbor act of 1894 appropriated $10,000 for continuing this improvement. After advertising for proposals, a contract, dated October 26, 1894, was entered into with John A. Bouker for extending the breakwater by furnishing and placing about 13,500 tons of riprap at the rate of 65 cents per gross ton. Work under this contract was begun December 6, 1894, and completed June 22, 1895. The total amount of stone delivered and placed was 12,983 tons, and the breakwater was extended 213 linear feet.

PRESENT CONDITION OF IMPROVEMENT.

The breakwater is now 1,289 feet long on top, the top being 4 feet above mean high water and 3 feet wide. It is in fair condition. The top of the work was somewhat disturbed by ice during the winter of 1894–95, but not enough to require immediate repairs.

The present end of the breakwater is at a depth of 22 feet at mean low water. The work contains about 68,735 tons of stone.

REVISED ESTIMATES.

Under a modification of the project, limiting the proposed length of the breakwater to about 2,000 feet, a revision of the estimates of cost of this work from the beginning was made, as follows:

140,000 tons of riprap, at 85 cents	$119,000
Contingencies, etc., about 15 per cent	16,000
Total	135,000

This modification and revised estimates were approved by the Chief of Engineers, June 22, 1895, and their insertion in the Annual Report was authorized. Therefore the estimate of amount yet required to complete this work is $80,000, being $135,000 less $55,000 already appropriated.

The reasons for this modification of project and revised estimate are fully stated in a letter to the Chief of Engineers, dated June 21, 1895, a copy of which is attached to this report.

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PROPOSED OPERATIONS.

Future appropriations should be applied to further extending the breakwater, as provided by the approved project.

Appropriations for improving Glen Cove Harbor, New York, have been made as follows:

Application.	Date.	Amount.
Breakwater	Aug. 11, 1888	$20.000
Do	Sept. 19, 1890	15.000
Do	July 13, 1892	10.000
Do	Aug. 17, 1894	10.000
Total		55.000

Glen Cove Harbor is in the collection district of New York. The nearest lighthouse is on Sands Point, about 4 miles west. Fort Schuyler, New York Harbor, is the nearest work of defense.

Money statement.

July 1, 1894, balance unexpended	$232.23
Amount appropriated by act of August 17, 1894	10,000.00
	10,232.23
June 30, 1895, amount expended during fiscal year	6,970 66
July 1, 1895, balance unexpended	3,261.57
July 1, 1895, outstanding liabilities	2,762.70
July 1, 1895, balance available	498.87
Amount (estimated) required for completion of existing project	80,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	50,000.00

*Abstract of proposals for breakwater construction at Glen Cove Harbor, New York, * * * opened by Lieut. Col. H. M. Robert, Corps of Engineers, at New York City, October 16, 1894.*

[Amount available, $9,000.]

No.	Name and address of bidder.	Price per ton (2,240 pounds).	Amount of stone per price bid.
1	Charles K. Stoll, 204 Bank street, New London, Conn	$1.49	6,040
2	Brown & Fleming, 129 Broad street, New York City	.75	12,329
3	John A. Bouker, 110 Wall street, New York City	*.65	13,846

* Lowest bid; accepted. Entered into contract October 26, 1894; contract completed June 22, 1895.

ENGINEER OFFICE, UNITED STATES ARMY,
New York City, June 21, 1895.

GENERAL: I have the honor to submit the following proposed modification of project for improving Glen Cove Harbor, New York, together with revised estimates of the cost of completing the work.

The present approved project was adopted in 1888 and provides for constructing a breakwater about 2,500 feet long, the top to be 5 feet wide and 3 feet above high water, with side slopes of 1 upon 1, at an estimated cost as follows:

136,000 tons of riprap, at $1.35 per ton	$183,600
Contingencies, 10 per cent	18,360
Total	201,960

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By the close of this fiscal year about 1,250 linear feet of this work will be built, at a total cost of $55,000.

On the occasion of a recent visit to Glen Cove, I particularly noticed the shelter afforded by the breakwater when built nearly to its present length. It is of very considerable area and provides a harbor which, with some crowding, will admit all vessels ordinarily to be expected there. To extend the breakwater 1,250 feet farther, making it 2,500 feet long, would, in my opinion, be a greater expense than the conditions warrant. The projected length could be reduced by 500 feet, at a saving, roughly estimated, of $45,000, and still provide all necessary accommodations for present and prospective commerce.

I am not sure but that it could properly be further reduced by 200 or 300 feet, but am prepared to recommend at present that the projected length be reduced to about 2,000 feet.

Experience in construction has shown that the original estimate of cost can be modified and made more accurate. The original estimates, based upon Coast Survey charts, apparently did not make sufficient allowance for the stone sinking into the bottom, which for about 7 feet depth is of quite soft mud. It now appears that to build 2,500 linear feet of this breakwater, the originally proposed length, would require 180,000 tons of stone instead of 136,000. The original estimate of cost was $1.35 per ton, but it has since been found that by using stone from excavations in New York City the price can be very much reduced. To get the best results as to price, either the bids should be asked for at a time when there is an abundance of such stone to be disposed of or else the period of contracts should be made so long that contractors can choose a time for getting stone to advantage. Four contracts have been awarded upon this work at rates, respectively, of 83 cents per ton (2,240 pounds), 80 cents per cubic yard (estimated at the time as nearly 1½ tons), 69 cents per ton, and 65 cents per ton. Under these contracts about 68,700 tons of stone have been delivered, at an average cost of 67 cents per ton.

It is probably safe to estimate that the price will not exceed 85 cents per ton, which is higher than yet paid.

To complete the breakwater to a length of 2,000 feet I would estimate the cost as follows:

70,000 tons of stone, at 85 cents	$59,500
Repairs during progress, about 10,000 tons, at 85 cents	8,500
Contingencies	12,000
Total estimated cost for completion	80,000
Or total estimated cost from the beginning	135,000

I would therefore respectfully recommend that the project for improving Glen Cove Harbor, New York, be modified to provide for a breakwater about 2,000 feet long, extending westerly from the northwest corner of Glen Cove Dock, the top to be 5 feet wide and 3 feet above high water, with side slopes of 1 upon 1, at an estimated cost (from the beginning) as follows:

140,000 tons of riprap, at 85 cents	$119,000
Contingencies, etc., about 15 per cent	16,000
Total	135,000

This is a reduction in the total estimated cost of $66,960.

If this proposition meets with the approval of the Chief of Engineers, I respectfully ask authority to state the modifications of plan and reduced estimate of cost in the annual report for the current fiscal year.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Colonel, Corps of Engineers.

Brig. Gen. WM. P. CRAIGHILL,
Chief of Engineers, U. S. Army.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1894.

These have been asked for but not yet received. In 1893 the freights by water were reported as—receipts, 160,000 tons; shipments, 145,000 tons. It is presumed that the business of 1894 would not materially differ from this.

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D 23.

IMPROVEMENT OF FLUSHING BAY, NEW YORK.

Flushing Bay is on the north shore of Long Island, about 14 miles by water from the Battery, New York City. The town of Flushing is on the east bank of Flushing Creek, just above the head of the bay. The bay is about 1 mile wide and 2 miles long. The bottom is of soft mud, nearly level, the depth in the original channel being not much greater than elsewhere. In 1861 a depth of 5 feet at low water was reported in the channel leading up to Flushing. At the beginning of the improvement by the United States the depth there was but 3.9 feet. The mean rise of tide is 7.1 feet.

PROJECTS FOR IMPROVEMENT.

A survey of Flushing Bay was made in 1878, and a project for improvement based upon the survey was proposed and adopted. This project provided for constructing two dikes, the first to extend northerly from the head (or south end) of the bay along the west side of the channel; then bending, to continue westward to Herrick Point, at the west side of the mouth of the bay, thus forming a large tidal basin which should fill and discharge through the main channel; the second to start from a point near the middle of the east shore and extend northwardly to the 6-foot curve, confining the channel. It also provided for dredging to make and maintain a channel 6 feet deep at mean low water. The estimated cost of this work was as follows:

Constructing 4,400 linear feet of pile dike, at $10 per foot	$44,000
Constructing 7,800 linear feet of pile dike, at $9 per foot	70,200
Constructing 900 linear feet of pile dike, at $7.50 per foot	6,750
Constructing 3,600 linear feet of single piling, at $3.70 per foot	13,320
For 83,000 cubic yards of dredging, at 20 cents per cubic yard	16,600
Contingencies	22,630
Total	173,500

All the timber work of the dike was to be creosoted.

The first appropriation was expended in building 3,057 linear feet of pile dike on the west side of the channel, extending northward from near the head of the bay. Subsequent appropriations until 1888 were expended in dredging to make and maintain the required channel depth, it being found necessary to dredge repeatedly in the same places. The total amount of material dredged in this period was about 235,000 cubic yards.

In September, 1888, a modification of the original project was approved, which provided for "extending the dike northward and toward the west side of the channel at College Point, and for dredging, omitting the dikes running westerly to Herrick Point, and the single row of piles on the east side." In 1891, owing to strong opposition to the dike by a large number of property owners at Flushing, College Point, and Newtown, further work upon it was discontinued, and the project was modified to provide for maintaining the channel by dredging only.

Up to July 1, 1894, 4,663 linear feet of the dike had been built. The channel, which has been dredged repeatedly, had fully the required depth of 6 feet at mean low water, with width of 70 to 100 feet.

A sketch of Flushing Bay was printed in the Annual Report of the Chief of Engineers for 1889, page 732.

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OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

The river and harbor act of 1894 appropriated $4,000 for continuing this improvement. After advertising for proposals, a contract dated January 15, 1895, was entered into with J. H. Fenner for repairing and widening the channel by dredging about 19,500 cubic yards of mud at the rate of 18 cents per cubic yard. Work under this contract has not yet been begun.

PRESENT CONDITION OF IMPROVEMENT.

The dike, 4,663 linear feet long, is in poor condition; the outer part of it, 1,606 feet long, which was left partly completed in 1891, has since then been much damaged by storms and ice. Further work upon the dike being discontinued, owing to the strong opposition of property owners along the shores of the bay (see Annual Report of the Chief of Engineers for 1892, Part 1, p. 723), it is not proposed to repair this damage. A small light at the outer (north) end of the dike, maintained by the Light-House Department, prevents the structure in its present condition being a serious menace to navigation of the bay.

PROPOSED OPERATIONS.

Under the existing contract shoals will be removed and the channel widened as far as the available funds will permit.

The required depth and nearly the full width of channel having been secured, future appropriations will be applied principally to maintaining the channel by dredging.

Appropriations for improving Flushing Bay have been made as follows:

Application.	Date.	Amount.
Construction of dike	Mar. 3, 1879	$20,000
Dredging	June 14, 1880	15,000
Do	Mar. 3, 1881	10,000
Do	Aug. 2, 1882	5,000
Do	July 5, 1884	10,000
Do	Aug. 5, 1886	10,000
Construction of dike and dredging	Aug. 11, 1888	15,000
Repair of dike and dredging	Sept. 19, 1890	20,000
Dredging	July 13, 1892	10,000
Do	Aug. 17, 1894	4,000
Total		119,000

Flushing Bay is in the collection district of New York. The nearest light-house is on North Brother Island, 3 miles to the northwest. There is a small light on the north end of the dike in the bay, maintained by the Light-House Department. Fort Schuyler and Willets Point, about 4 miles east from the mouth of the bay, are the nearest works of defense.

Money statement.

July 1, 1894, balance unexpended	$591.25
Amount appropriated by act of August 17, 1894	4,000.00
	4,591.25
June 30, 1895, amount expended during fiscal year	395.27
July 1, 1895, balance unexpended	4,195.98
July 1, 1895, amount covered by uncompleted contracts	3,510.00
July 1, 1895, balance available	685.98
Amount (estimated) required for completion of existing project	54,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893	

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Abstract of proposals for dredging in Flushing Bay, New York, opened by Lieut. Col. H. M. Robert, Corps of Engineers, at New York City, January 3, 1895.

[Amount available, $3,500.]

No.	Name and address of bidder.	Price per cubic yard, scow measure.	Cubic yards based on price bid.
		Cents.	
1	John H. Fenner, Jersey City, N J.*	18	19,444
2	Elijah Brainard, 24 State street, New York City	32	10,937
3	Charles and Henry E. Du Bois, 119 South street, New York City	28	12,500

* Lowest bid; accepted. Entered into contract January 15, 1895; work not yet begun.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1894.

[Through courtesy of Boyer's Flushing and College Point Freight Line.]

Arrivals and departures of vessels.

[Draft, 6 to 14 feet; tonnage, 50 to 350 tons.]

Kind of vessels.	Number of round trips.	Aggregate tonnage of all trips.
Steamers	305	16,602
Sailing vessels	200	13,340
Barges	60	17,000
Total	565	46,942

Freight received and shipped by water.

Chief articles.	Tons.	Estimated value.
Receipts:		
General cargo	8,194	$819,400
Logwood, etc.	7,500	216,000
Coal, stone, building materials, and ice	22,340	143,395
Miscellaneous (not otherwise included)	500	8,000
Total receipts	38,534	1,186,795
Shipments:		
Logwood extracts	8,408	1,261,200
Total receipts and shipments	46,942	2,447,995

No new lines of transportation have been established since July 1, 1894.

The above figures show a total of 46,942 tons, but no complete data for comparison have been received since 1888, when 229,235 tons was reported. It is difficult to obtain complete and satisfactory estimates of the commerce of Flushing Bay, but it is not believed that it has decreased to the extent which these figures would indicate.

The above figures are estimated by Messrs. L. Boyer's Sons to be about 10 per cent under the actual commerce of the harbor, owing to delay or neglect of some parties to supply information; they also estimate that, owing to dull times, the general business of the harbor was about 15 per cent below a fair average.

D 24.

IMPROVEMENT OF PATCHOGUE RIVER, NEW YORK.

Patchogue River is a small stream on the south side of Long Island, emptying into Great South Bay, near its eastern end, and about 55 miles in a direct line east from New York City. The village of Patchogue,

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which lies about a mile north of the mouth of the river, has a resident population of about 5,000, which is considerably increased during the summer months.

The approach to Patchogue River by water is through Fire Island Inlet, and thence by a rather crooked course for some 14 miles through Great South Bay; the depth through the bay and up to within a half mile of the river's mouth is about 8 feet; at the mouth of the river the natural depth shoaled up to about 2 feet, which depth could be carried up to the village landings.

About the year 1870 the State of New York made an appropriation for improving the entrance to this river. A jetty about 1,000 feet long was built from the west side of the mouth of the river and a channel dredged alongside of it. The jetty was built of a single row of sheet piling, with round piles at intervals of 6 feet, and riprapped along the sides. In 1891 about 200 linear feet of the piling remained, but was badly injured; the riprap could be traced for nearly the whole length of the work, but no trace of the dredged channel remained.

The mean rise of the tide at Patchogue River is 1.1 feet.

PROJECTS FOR IMPROVEMENT.

The river and harbor act of June 4, 1880, provided for a survey of the river, which was made that year; the report, dated October 30, 1880, and printed in the Annual Report of the Chief of Engineers for 1881, page 674, contained estimates for a plan of improvement as follows:

The estimate to secure a depth of 6 feet at mean low water by dredging in the river, and from its mouth to the 6-foot curve in the bay is	$21,000
For diking from river to 6-foot curve in bay	15,800
Engineering, contingencies, etc., 15 per cent	5,520
Total	42,320

One dike was to be on the west side of the river's mouth and another and shorter one on the east side, the total length of the two to be about 2,400 feet, to be of carbolized timber filled with riprap, and to be from 5 to 7 feet wide from out to out.

Nothing had been done toward the desired improvement, and in 1886 another examination (ordered by the river and harbor act of that year) was made.

The report on this examination is printed in the Annual Report of the Chief of Engineers for 1887, page 759. This report contained a project and estimate for dredging a channel 60 feet wide and 6 feet deep from the highway bridge at Patchogue (4,000 feet above the mouth of the river) to the 6-foot curve in Great South Bay, a total length of about a mile, and to protect the channel in the bay by a dike or jetty on its west side 1,700 feet long. The plan also mentioned the possible necessity of a dike on the east side, but it was not included in the estimates, which were as follows:

Dredging from the head of navigation at the bridge to the 6-foot contour in Great South Bay, the channel being 60 feet wide and 6 feet deep, would require the removal, by scow measurement, of about 60,000 cubic yards of sand, at 30 cents per cubic yard	$18,000
Diking, 1,700 linear feet, at $10 per linear foot	17,000
Superintendence, contingencies, etc	5,000
Total	40,000

Beginning of work under this project was approved by the Secretary of War October 4, 1890, after the first appropriation for the improvement had been made.

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Up to July 1, 1894, the jetty had been built 1,340 feet long, terminating in 4½ feet depth of water; the top was 1 foot above high water and 3 feet wide. The dredged channel had been extended to Gilberts Point, about 1,200 feet inside the mouth of the river, with width of 60 to 150 feet and depth from 6 to 12 feet, some private dredging having been done to considerable depth to obtain material for filling on marsh lands. The channel outside the mouth of the river has shoaled somewhat since it was dredged in 1890.

Harbor lines for Patchogue River were established by the Secretary of War under date of January 17, 1894.

A sketch of Patchogue River was printed in the Annual Report of the Chief of Engineers for 1893, page 984.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

By the river and harbor act of 1894 $4,000 was appropriated for continuing this improvement. It has been decided to apply the funds to dredging, to repair, and extend the channel, but before a contract for dredging can be awarded an examination is necessary to determine the most economical method of disposing of the material. This examination will be made early in the ensuing year.

PRESENT CONDITION OF IMPROVEMENT.

The channel from Great South Bay to the mouth of the river, dredged 50 feet wide and 6 feet deep in 1891, has shoaled so that the available depth is now less than 5 feet at mean low water. Above the entrance, to Gilberts Point, the depth is fully 6 feet and width from 60 to 150 feet, partly dredged at private expense. Above Gilberts Point the available depth to the head of the stream is 3½ feet, though it is considerably deeper in places, the result of private dredging.

The jetty is in fair condition; it was damaged slightly by ice during the winter of 1892–93, but not so as to urgently need repair.

PROPOSED OPERATIONS.

With the funds now available the dredged channel will be repaired and extended up stream.

Future appropriations should be applied to completing the dredged channel and extending the jetty.

Appropriations for improving Patchogue River, New York, have been made as follows:

Application.	Date.	Amount.
Constructing jetty and dredging	Sept. 19, 1890	$15,000
Dredging	July 13, 1892	8,000
Do	Aug. 17, 1894	4,000
Total		27,000

Patchogue River is in the collection district of New York. The nearest lighthouse is at Fire Island Inlet, 14 miles southwest. The nearest work of defense is Fort Hale, New Haven Harbor, Conn., about 35 miles in a direct line northward.

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Money statement.

July 1, 1894, balance unexpended	$594.20
Amount appropriated by act of August 17, 1894	4,000.00
	4,594.20
June 30, 1895, amount expended during fiscal year	552.50
July 1, 1895, balance unexpended	4,041.70
Amount (estimated) required for completion of existing project	13,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	13,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1894.

[Through courtesy of Messrs. E. Bailey & Sons, Patchogue, N. Y.]

Arrivals and departures of vessels.

[Draft, 4 to 9 feet; tonnage, 8 to 500 tons.]

Kind of vessels.	Number of round trips	Aggregate tonnage of all trips
Steamers	200	60,000
Sailing vessels	900	55,000
Barges	350	65,000
Total	1,450	180,000

Freight received and shipped by water.

Chief articles.	Tons.	Estimated value
Receipts (lumber, coal, brick, stone, oysters, and general merchandise)	115,000	$1,400,000
Shipments (lumber, oysters, etc.)	30,000	400,000
Total	145,000	1,800,000

These figures show an increase of 20,000 tons over the amount of freight reported for 1893.

Vessels built during 1894, ranging from 10 to 75 tons, about 25. Vessels repaired during 1894, ranging from 8 to 300 tons, about 100.

Two steam ferry and transportation lines have been established since July 1, 1894.

Number of oyster boats and small vessels belonging in the harbor, 200 to 350.

Number of vessels using harbor for shelter or for night, which could not have used it before the improvement, over 200.

Amount of oysters taken during the year by vessels belonging in the harbor, 100,000 to 150,000 bushels.

The above is mainly from estimates, but is stated to be fairly accurate. The vessels of 9 feet draft can not come into Patchogue River without lightering.

D 25.

IMPROVEMENT OF BROWNS CREEK, SAYVILLE, LONG ISLAND, NEW YORK.

Browns Creek is a small stream flowing midway between the villages of Sayville and Bayport, near the south shore of Long Island, and emptying into Great South Bay about 11 miles northeast of Fire Island Inlet. From Fire Island Inlet to the vicinity of Browns Creek there is a rather crooked channel of 8 feet available depth. The original

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entrance to the creek was crooked, narrow, and shifting. Its depth at mean low water was about 0.4 foot. In the stream itself the low-water level was from 0.3 to 1.3 feet higher than low water in Great South Bay, and the channel depth from zero to 3 feet below low water in the bay. The width of the stream from the bay to the highway bridge, about 5,000 feet, averages 77 feet. Its course lies through a marsh from one-quarter to one-half mile in width, separated from the bay by a low and narrow beach. In its natural condition this stream was not available for any purpose of navigation.

The permanent population of Sayville is said to be 3,500.

The mean rise of tide in Great South Bay is 1.1 feet; at the highway bridge, except in dry seasons, it is scarcely noticeable.

PROJECT OF IMPROVEMENT.

In pursuance of the river and harbor act of August 11, 1888, a survey of Browns Creek was made, the report on which was printed in House Ex. Doc. No. 22, Fifty-first Congress, first session; and also in the Annual Report of the Chief of Engineers for 1890, Part I, pages 669–674. With this report plans and estimates for work were presented as follows:

The object of the desired improvements is to secure an anchorage ground or place where the fishing boats can lie in safety during rough weather. This can be accomplished by widening and deepening the creek and improving its mouth. To prevent the entrance from filling up by drift and wave action, jetties will probably be needed on both sides, certainly on the west side, as the drift of sand along the shore is from west to east. The jetties should be of riprap, the top and slopes to be of stone weighing not less than one-fourth ton, the top to be 3 feet wide and 1 foot above high water, with slopes of 1 on 1. The stone on the top and slopes should be selected and carefully laid, so as to present as smooth a surface as possible, to resist the action of the moving ice.

The cost of dredging a channel 100 feet wide and 6 feet deep at mean low water from the 6-foot curve in the bay up to the first bend in the creek (1,850 feet) is estimated to be:

33,000 cubic yards, at 30 cents per cubic yard, the material to be deposited in the bay	$9,900
For a 4-foot channel 100 feet wide above this point to the highway bridge, 4,680 feet, 86,000 cubic yards, at 14 cents per cubic yard, the materials to be placed on the banks	12,040
Cost of west jetty, 1,600 feet long, 3,700 cubic yards of riprap, at $2.50 per cubic yard	9,250
Cost of east jetty, 1,400 feet long, 3,100 cubic yards of riprap, at $2.50 per cubic yard	7,750
Contingencies	7,060
Total	46,000

The first work to be done should be the deepening at and near the mouth, and the construction of jetties, commencing at the shore end. These works should be carried on simultaneously.

This improvement would not only benefit those engaged in oystering and fishing, but would enable many articles of commerce to be brought to Sayville by water, instead of by rail, as at present. A partial improvement would be of great benefit to small vessels.

The beginning of work under this project was approved by the Secretary of War October 4, 1890, after the first appropriation for improving Browns Creek had been made.

Up to July 1, 1894, 492 feet of the west jetty and 438 feet of the east jetty had been built to a height of 1 foot above mean high water and the dredged channel had been made 1,893 feet long, 100 feet wide, and 4 feet deep at mean low water.

A sketch of Browns Creek was printed in the Annual Report of the Chief of Engineers for 1894, page 710.

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OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

The river and harbor act of 1894 appropriated $4,000 "for maintenance" of this improvement. To determine what kind of work is necessary for maintenance requires a special examination of the present condition of the channel, which will be made early in the ensuing year.

PRESENT CONDITION OF IMPROVEMENT.

The west jetty has been made 492 feet long and the east jetty 438 feet long, both with top width of 3 feet at height of 1 foot above mean high water. Since work on them was suspended in August, 1892, they have suffered trifling damage from ice, but not such as to require immediate repair; they are in fair condition.

The dredged channel has been made 1,893 feet long, 100 feet wide, and 4 feet deep at mean low water. About 1,400 feet of this channel lies inside the shore line and is used freely for night anchorage by small oyster boats owned and operated in the vicinity. Private canals have been dredged into the east bank of the creek by the owners of the property, amounting in aggregate to 1,525 linear feet. This additional area is used both for business purposes and for anchorage.

Some shoaling in this channel has been reported.

PROPOSED OPERATIONS.

The available funds being specially appropriated for maintenance of the existing work, they will be so applied early during the ensuing year.

Future appropriations will be applied to maintaining and extending the channel and to completing the jetties as provided for in the approved project.

Appropriations for improving Browns Creek have been made as follows:

Application.	Date.	Amount.
Constructing jetties and dredging	Sept. 19, 1890	$12,000
Dredging	July 13, 1892	5,000
Do	Aug. 17, 1894	4,000
Total		21,000

Browns Creek is in the collection district of New York.

The nearest light-house is at Fire Island Inlet, about 11 miles southwest.

The nearest works of defense are the fortifications at Willets Point, New York, about 35 miles west, and Fort Hale, New Haven Harbor, Connecticut, about the same distance northeastwardly.

Money statement.

July 1, 1894, balance unexpended	$200.83
Amount appropriated by act of August 17, 1894	4,000.00
	4,200.83
June 30, 1895, amount expended during fiscal year	2.11
July 1, 1895, balance unexpended	4,198.72
Amount (estimated) required for completion of existing project	25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	20,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

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COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1894.

Draft of vessels using harbor	feet..	2 to 5
Oyster boats and small vessels belonging in harbor, estimated at		260
Amount of oysters taken during the year by vessels belonging in harbor (estimated about)	bushels..	250,000
Vessels (estimated) using harbor for shelter or for night which could not have used it before improvement, over		240
Largest number of vessels observed at one time in the harbor: No actual count appears to have been made, but on many occasions the harbor has been filled with boats up to its entire capacity, leaving only a passageway in and out, and during the past winter has been in much more general use than ever before.		
Vessels built during 1894 (ranging from 4 to 12 tons)		3
Vessels repaired in 1894 (ranging from 5 to 40 tons)		60

One new line of transportation has been incorporated to run a ferry between Sayville and Fire Island Beach.

LETTER FROM MR. JOSEPH WOOD, OF SAYVILLE, N. Y.

SAYVILLE, LONG ISLAND, N, Y., *June 5, 1895.*

DEAR SIR: The foregoing statistics are the nearest approximation obtainable from reliable sources. In addition, attention is directed to the following:

5,000 bushels of shells (for road purposes) were actually landed at Browns Creek; 20,000 bushels of mussels (for fertilizer) were landed on the bank of this creek; 30,000 bushels of oysters were landed at the creek, for culling and shipment by rail; 20 tons of edible fish for New York markets were landed and iced at this creek for shipment by rail; 3,000 tons of general freight, such as coal, brick, and lumber, were landed here. In addition to oysters taken and above reported, a great many thousand clams (reliable estimate not obtainable) were taken during the year by vessels belonging in this harbor.

All these figures are from careful estimates by well-informed men.

Very respectfully, yours,

JOSEPH WOOD.

(On behalf of the Village Improvement Society of Sayville and Bayport.)

D 26.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

1. WRECK OF SCHOONER CLARA E. SIMPSON, NEAR EATONS NECK, LONG ISLAND SOUND, NEW YORK.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., January 25, 1895.

GENERAL: I have the honor to submit the following report upon examination of a wreck in Long Island Sound, near Eatons Neck, and upon the removal of masts therefrom. (File No. 9535.)

The wreck referred to was the three-masted schooner *Clara E. Simpson*, owned by Thomas H. Ryder, of Portsmouth, N. H., net tonnage 371.64, bound to New York with a cargo of paving stones. It appears that this vessel came into collision with the steamer *Dorian* at 11 o'clock on the night of Tuesday, December 4, 1894, and was sunk in Long Island Sound, about 2 miles north from Huntington light-house, on Eatons Neck.

The wreck was first reported to me December 18, 1894. The location of the wreck was in the direct line of sailing of several of the larger passenger steamers running through Long Island Sound, and she was considered a source of danger to those boats. As the reports stated that her mastheads were just awash, it seemed that she must be lying

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in water of at least 75 feet depth, and that removal of the masts would remove every obstruction which passing vessels could strike. I reported these facts to the Chief of Engineers December 20, 1894, and upon my recommendation an allotment of $300 was made from the permanent indefinite appropriation for removal of sunken vessels or craft obstructing or endangering navigation—act of June 14, 1880—to pay the expenses of examination and, if found practicable at the same time, of removing the parts of the wreck which were dangerous to vessels.

The locality being very exposed and about 2 miles distant from the nearest shore, comparatively still and clear weather was necessary for finding and examining this wreck, and the work was considerably delayed to await suitable weather. Finally, on January 17 and 18, a fairly favorable opportunity presented, and the wreck was thoroughly examined. The masts were readily found, but all that remained were one large spar floating heel up, the top being held down by the rigging attached to the crosstrees, and one topmast detached from its mast but held down by wire rigging. The place was thoroughly dragged, using a weighted rope sunk to 25 feet depth; and again, on the 18th of January, using a grappling iron at 30 feet depth, but no other obstructions could be found. By the use of four charges of dynamite, about 10 pounds each, these spars were separated from the rigging and blown to comparatively small pieces, after which the rigging sank and nothing remained at a less depth than 25 feet, or probably less than 75 feet. Twenty-five feet was the depth sought, because a shoal puts out from Eaton's Neck which in the immediate vicinity has depths of scant 20 feet, and such vessels as pass through Long Island Sound with over 18 feet depth (which are very few) are compelled to take a course farther northward.

On the afternoon of the 17th the water became too rough for further operations, which necessitated delay until the 18th for final completion of the work.

The examination was made and during its progress all parts of the wreck above 25 feet below ordinary low-water level were removed at but slightly greater cost than for the examination alone. The total cost of this work was $111.90.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

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2. WRECK OF SCHOONER GEO. HOTCHKISS IN NEW HAVEN HARBOR, CONNECTICUT.

This is an old wreck, originally belonging to Mr. George Hotchkiss, of New Haven, Conn., who many years ago brought her into the upper part of New Haven Harbor, on flats opposite Messrs. Halstead & Harmount's lumber wharf, and there abandoned her. Messrs. Halstead & Harmount then removed her away from their front to flats now owned by the Starin Transportation Company. These flats were inside the city harbor lines. In 1893 Mr. Starin wished to extend his dock, and as Mr. Hotchkiss, the owner of the wreck, refused to remove her, Mr. Starin placed her where she now lies, southwest of Long Wharf and outside the harbor lines.

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The harbor commissioners of New Haven made complaint about this wreck April 23, 1894, but requested that action be deferred until the city harbor lines were established and confirmed by action of the Secretary of War, which action was taken November 17, 1894. Mr. Starin was informed of the facts and replied that he had originally wished to blow the wreck up, but had been informed that he had no legal right to do so, and further stated that he was still prepared to destroy her if he could get authority to do so. The complaint and Mr. Starin's proposition were forwarded to the Chief of Engineers January 16, 1895. By action of the Secretary of War, dated January 19, 1895, the vessel was declared a derelict and Mr. Starin was authorized to destroy her. He made preparations to do so in the winter, but was prevented by severe weather and ice, and the wreck is not yet removed. Mr. Starin states, however, that he intends to destroy it early in the ensuing year.

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3. WRECK OF THE BARK HOPPET, WITH TWO CANAL BOATS ALONGSIDE, IN MANHASSET BAY, LONG ISLAND, NEW YORK.

These hulks were brought into Manhasset Bay several years ago, the intent being (as stated) to remove them elsewhere and break them up; but they were left there until they became so decayed and waterlogged that they were not worth removing. In their present condition they are more or less of a menace to navigation, though partly visible even at high water, and they are very liable to cause the formation of a shoal, which would interfere with navigation even more than the wrecks themselves. It is represented that such a shoal is already forming.

Complaint against this wreck was made by the supervisor of the town of North Hempstead, which was forwarded to the Chief of Engineers April 8, 1895. An examination of the wrecks was authorized and made; subsequently the sum of $750 was allotted for their removal. After duly advertising, proposals for doing the work were opened June 12, 1895, and the lowest offer, made by Mr. M. H. Gregory, of Great Neck, N. Y., was accepted, for entirely removing the three hulks for the sum of $590. Work is now in progress.

Abstract of proposals for removing wrecks in Manhasset Bay, Long Island, New York, received in response to public notice of ten days, dated May 29, 1895, and opened June 12, 1895, by Col. H. M. Robert, Corps of Engineers.

[Amount available for work, about $700.]

No.	Name and address of bidder.	Price bid.
1	Townsend & Johnston, Somers Point, N. J	$2,750
2	Chas. Smedley, 128 Kemble Building, New York City	900
3	Chapman Derrick and Wrecking Co., 70 South street, New York City	1,113
4	Wm. R. Plyer, Great Neck, Long Island	830
5	M. H. Gregory, Great Neck, Long Island	*590

*Lowest bid; accepted; work in progress.

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D 27.

PRELIMINARY EXAMINATION OF HARBOR OF WEST HAVEN AND OF WEST RIVER FROM THE STEAM RAILROAD CROSSING TO THE MAIN CHANNEL OF NEW HAVEN HARBOR, CONNECTICUT.

[Printed in House Ex. Doc. No. 27, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1894.

SIR: I have the honor to submit the accompanying copy of report, dated November 8, 1894, by Lieut. Col. Henry M. Robert, Corps of Engineers, giving results of preliminary examination of harbor of West Haven, Conn., and West River "from the steam railroad crossing to the main channel of New Haven Harbor," made to comply with provisions of the river and harbor act of August 17, 1894.

I concur in the opinion of Colonel Robert that this locality is worthy of improvement by the General Government.

No survey is necessary at this time, the results of one made in 1875, with the observations made on this preliminary examination, affording sufficient data for the preparation of plan and estimate for this improvement.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. DANIEL S. LAMONT,
Secretary of War.

REPORT OF LIEUT. COL. H. M. ROBERT, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., November 8, 1894.

GENERAL: I have the honor to submit the following report upon the preliminary examination of the harbor of West Haven, and West River from the steam railroad crossing to the main channel of New Haven Harbor, Connecticut, made in pursuance of the river and harbor act of August 17, 1894.

West Haven Harbor is a bay on the west side of New Haven Harbor, Connecticut, extending about a mile westward and being about a mile long, north and south. West River is a stream about 15 miles long, emptying into the harbor from the north. In the lower part of its course it is a tidal stream of, say, 100 to 200 feet width, following a rather crooked course through a wide salt marsh. Kimberly avenue, the most important highway between New Haven and West Haven, crosses the head of West Haven Harbor at the mouth of West River. Over the marsh the road is built upon a solidly filled causeway, and over the channel of the stream it is a pile bridge 300 feet long.

An electric railway crosses the bridge, which has no draw, but has an open span of 24 feet clear width, with clear height of about 5 feet above mean high water.

The steam railroad bridge referred to in the act is the bridge of the New York, New Haven and Hartford Railroad, which crosses the marsh and West River on a trestle, about 2,000 feet above the Kimberly Avenue Bridge, and which is without a draw.

The channel of the harbor below the Kimberly Avenue Bridge is narrow and crooked, with an available depth of scant 3 feet at mean low water, with broad flats on one or both sides. Between this bridge and

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the railroad bridge the available depth is about the same. The mean rise of tide is 6 feet.

The river and harbor act of 1875 directed a survey of the channel of West Haven Harbor, which was made and platted in the fall of that year. This survey extended only to the Kimberly Avenue Bridge. The report on the survey is printed in the Annual Report of the Chief of Engineers for 1876, Part 1, page 233. At that time the improvement desired was to make the channel 6 feet deep at mean low water, and the cost of dredging such a channel, with a width of 60 feet, was estimated at $11,340. The population of West Haven then was about 3,000, and the local traffic in lumber, coal, and shipbuilding which would be benefited by such an improvement was estimated to amount to $100,000 per year.

The depths in the harbor have not changed in any essential respect since 1875.

The improvement now desired is to open up a navigable channel to the railroad bridge, as a benefit to the local industries, such as contemplated in 1875, and further to enable manufactories (some already established below the railroad and others contemplated) to bring in their raw materials and supplies without delay and without lightering. This location for a short distance below the railroad and on either side of the channel possesses peculiar advantages for manufacturing, in that it has convenient access by rail for the shipping of manufactured products and has water approaches for the bringing of heavy supplies, which are now partially utilized and are capable of great improvement at a moderate cost. These combined advantages, which are so necessary to success in the competition of modern times, are found in very few places about New Haven and in no places not already occupied. The desired improvement should be looked upon as in the interest of New Haven as well as of West Haven.

The commerce of West Haven Harbor and West River at present aggregates over 33,000 tons per year, roughly estimated to be worth $350,000. It consists, in the main, of coal, lumber and building materials, fertilizers, and fire clay. In addition to this there is a shipbuilding firm which has been located on the harbor for thirteen years past, and during that time has built wooden vessels aggregating 20,000 tons and drawing unloaded when launched from 7 to 10 feet.

The business is carried on at five wharves, the uppermost being just below the railroad and the lowest being a little over a quarter of a mile below Kimberly avenue. All this business is carried on at a disadvantage, as vessels can enter the harbor only at high tide and even then with limited draft. It is claimed that the commerce is increasing every year from sheer force of necessity, notwithstanding the lack of accommodation, because there is no other available water front where it could be done.

In my opinion West Haven Harbor, including West River up to the steam railroad bridge, is worthy of improvement by the General Government. No survey is necessary; the map of the survey of 1875, with the observations made on the preliminary examination, affords sufficient data for preparing a plan and estimate for the improvement.

Appended are extracts from letters bearing upon the importance of the desired work.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

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[Extract from letter of Mr. Henry Sutton, of West Haven Conn., dated August 27, 1894.]

* * * * * * *

My industry consists of a shipyard located on said river about 1,000 feet below the bridge known as the Kimberly Avenue Bridge, which connects West Haven with New Haven, consisting of about 700 feet on the water front, with buildings and suitable outfit thereon to conduct a shipyard. I have had a continuous lease of this yard for the past thirteen years, have built and launched wooden vessels representing over 20,000 tons, with a draft of water from 7 to 10 feet (light). In order to successfully launch and float these vessels to New Haven Harbor channel it is necessary to launch on the highest course of tides, which then only gives us about 8 feet of water and a very narrow and crooked channel. We have been frequently detained from one to two weeks getting out to deep water, with the aid of powerful tugs at considerable expense and damage to my vessels. This at present is the situation, and I sincerely believe that if the appropriation asked for is granted I could more than double my industry alone. It would also increase the business of others that are now located, and encourage new enterprises which are now considering the advisability of locating in this locality.

* * * * * * *

[Extract from letter of Mr. H. M. Howard, of New Haven, Conn., dated August 27, 1894.]

* * * * * * *

On West River, between Kimberly avenue and the line of the New York, New Haven and Hartford Railroad Company's bridges, I own about 1,000 feet of land bordering on the channel. Should a drawbridge be built over this main channel at Kimberly avenue and a waterway from 10 to 12 feet be made from the railroad to the main channel of New Haven Harbor, this property spoken of could and would be made very valuable for wharf purposes, and would not only have water, but railroad connection also.

In the present condition of the channel boats drawing 9 feet of water can get up the river at mean high tide. Very lately a corporation of first-class financial standing were desirous to locate on this property, and I have every reason to believe that they would have done so if there had been sufficient depth of water for their boats. * * *

Beyond the reasons for wishing the improvements named, I will say a large section of the western part of the city of New Haven can be more conveniently and cheaply reached with coal, lumber, etc., from West River Channel than from any other water front.

* * * * * * *

[Extract from letter of the treasurer of The E. A. Chatfield Company, of New Haven, Conn., dated August 27, 1894.]

* * * * * * *

This channel and West Haven Harbor, as far as the bridge at Kimberly avenue, have been used extensively for some time past, and the channel for its entire length up to the railroad bridge has been used for the last two years by boats carrying goods to the dock of The E. A. Chatfield Company, which company I represent.

* * * * * * *

All the (six) firms mentioned have docks or yards below the Kimberly Avenue Bridge. Above the bridge the only dock where material is landed is that of The E. A. Chatfield Company, whose tonnage is now upward of 5,000 tons. The prospects for more business at West Haven Harbor, and especially for that portion between Kimberly Avenue Bridge and the railroad bridge, are good, for the reason that the railroad corporations have bought or control nearly all the docks having good water facilities, and people wishing to put factories, lumber yards, coal yards, etc., at the water's edge will be forced to seek the West Haven Channel in order to find a place, and that part of the channel lying between the two bridges named seems to me to be the part most liable to be utilized at an early day, because of the fact that firms building docks or having factories alongside or near this channel can also have railroad facilities.

Should any dredging be done in the part of the channel near the two bridges spoken of, the material would be of greater value for filling in land that could be occupied for dock room. In a few months a plant for supplying electric lights in

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West Haven will probably be either built near or added to the power plant of the Winchester Avenue Railroad Company, and which, if done, would increase the coal tonnage materially.

The electric roads about New Haven and West Haven are increasing their mileage very fast, and there is no place as well situated for a power plant as the land bordering on West Haven Channel, and it will soon be necessary to either increase the present plant now located on this channel, or build a new power station.

Mr. L. Sanderson, of this city, is contemplating building a factory on the west side of West River Channel near the New York, New Haven and Hartford Railroad Company's line, and has purchased property costing about $10,000 for a factory site, and if a drawbridge is erected at Kimberly avenue will expend several thousand dollars in building docks, storehouses, etc. The amount of goods he would land at West River Dock would be about 12,000 tons per year.

Land can be bought at a reasonable price along West River Channel on both sides, and as dock property that has railroad and water facilities in New Haven is very scarce indeed, and the price so high that it is almost prohibitory, all persons wanting rail and water connections will be forced to use West River docks in order to get freight by water, or ship by rail or water at reasonable prices. Should the channel of West River be dredged and a drawbridge erected at Kimberly avenue, The E. A. Chatfield Company would increase the amount of goods landed at their dock to 12,000 tons per year.

At present New Haven business firms are foremost in taking advantage of this waterway, as they can not carry on business enterprises, purchase or lease dock room at existing wharves in New Haven profitably. With a channel of the depth spoken of steamboats with excursion passengers could and probably would land alongside Kimberly avenue, and connect with the electric railroad cars to Savin Rock and other shore resorts which are visited daily in the summer season by thousands of people. At present the route from dock to shore is over two lines of road and is long, tedious, and dangerous, the passengers having to cross the tracks of a steam road at a busy grade crossing.

* * * * * * *

D 28.

PRELIMINARY EXAMINATION OF BLACK ROCK HARBOR, CONNECTICUT.

[Printed in House Ex. Doc. No. 46, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1894.

SIR: I have the honor to submit herewith a copy of report of October 3, 1894, by Lieut. Col. H. M. Robert, Corps of Engineers, of the results of a preliminary examination of Black Rock Harbor, Connecticut, made to comply with requirements of the river and harbor act of August 17, 1894.

It is the opinion of Colonel Robert, concurred in by this office, that Black Rock Harbor is worthy of improvement by the General Government so far as relates to deepening, widening, extending, and protecting the existing channel.

No further survey is necessary to prepare plan and estimate for improvement of this locality.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

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REPORT OF LIEUT. COL H. M. ROBERT, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., October 3, 1894.

GENERAL: I have the honor to submit the following report upon preliminary examination of Black Rock Harbor, Connecticut, made in pursuance of the river and harbor act of August 17, 1894.

Black Rock Harbor includes a lower harbor about 1½ miles long, from northeast to southwest, and about a half mile wide at the widest, and an upper harbor consisting mainly of two tidal inlets, the easterly one called Cedar Creek and the westerly one called Burr Creek. The outer harbor is sheltered on the north and west by the mainland, on the southeast by Fayerweather Island and a breakwater connecting it with the shore, and on the southwest it is partially sheltered by Fairfield Bar, a sand bar over a mile long and about awash at half tide. The lower part of the harbor is exposed to the southeast.

That part of the harbor which is sheltered by Fayerweather Island has depths of from 6 to 9 feet, and was formerly much used as a harbor of refuge for vessels overtaken by storms, but the depth is not sufficient for the deeper vessels now generally in use. The natural depth in Cedar Creek was from 2 to 4 feet at mean low water, and in Burr Creek but 1 foot or less.

IMPROVEMENTS BY THE UNITED STATES.

Between 1836 and 1838 $21,500 was expended in building a sea wall across a breach in Fayerweather Island to preserve the light-house reservation at the south end of the island, and to prevent shoaling in the anchorage ground.

The river and harbor act of 1882 ordered a survey of Black Rock Harbor, which was made in 1883, and a project for improvement was submitted, providing for construction of a breakwater to connect Fayerweather Island with the mainland to the northeast, and for dredging a channel 6 feet deep at mean low water and 80 feet wide through the harbor and up Cedar Creek, at an estimated cost of $80,000. Work under this project was begun in 1885, and the project was completed in January, 1894, after $40,000 had been appropriated by Congress and expended upon the work. The breakwater was made 2,744 feet long in 1885, with the top slightly above high-water level; it answered the purpose of protecting the inside channel and the further enlargement provided in the project was unnecessary. The channel was made the full depth and width provided for, with much increased dimensions in places, due to private dredging.

The river and harbor act of 1888 directed a preliminary examination of "Black Rock Harbor, for breakwater to Penfield Reef and south from Fayerweather Island." The examination was made and report on the same, dated October 30, 1888, was transmitted to the Chief of Engineers, and was printed in the Annual Report of the Chief of Engineers for 1889, page 741. That report stated that the harbor was, in the opinion of the officer in charge, worthy of improvement; that no survey was needed, as the recent Coast Survey chart afforded all necessary information, and that the estimated cost of a sufficient harbor of refuge would be about $157,000. The project has not been adopted.

PRESENT CONDITION OF THE HARBOR.

Black Rock Harbor now has a depth of 12 feet at mean low tide at the south end of Fayerweather Island, decreasing to 6 feet, which depth with a width of about 80 feet can be carried up Cedar Creek to

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the head of the harbor; a greater depth has been made at places by private work, but it is not continuous. In Burr Creek the channel is practically bare at low tide.

The old sea wall on Fayerweather Island, which was considerably injured by storms in 1893 and 1894, was partly repaired in the winter of 1893–94, under an allotment from the appropriation for examinations, surveys, and contingencies of rivers and harbors; it is to be further repaired under the appropriation of 1894 for improving Black Rock Harbor, but additional repairs will probably be needed from time to time to maintain the structure.

The breakwater connecting Fayerweather Island with the mainland on the north is in good condition.

NATURE OF IMPROVEMENT NOW DESIRED.

This preliminary examination, as I understand, was asked for in order to present before Congress the importance of a further improvement in extension of the project adopted in 1884 and completed in 1894. The completion of this project gave a depth of 6 feet at mean low water in a narrow channel to the head of Cedar Creek. The depth and width were in 1884 believed to be sufficient for the then existing commerce, but they are found to be inadequate to the present commerce, and an increase in depth and width is desired, as is also an extension of the channel up Burr Creek, the west branch of the harbor.

It is also desired that the lower part of the harbor be protected from the south and southwest by a breakwater along Fairfield Bar and by one in extension of Fayerweather Island.

PRESENT AND PROSPECTIVE COMMERCE.

The commerce of Black Rock Harbor for several years past has been given in the annual reports of the Chief of Engineers upon the improvements in progress.

The following table shows the gradual increase of harbor commerce from the beginning of the improvements just completed to the present time:

Year.	Freight by water.		Vessels carrying freight.			Number of vessels entered harbor for refuge only.
	Tons.	Estimated value.	Number.	Draft.	Tonnage.	
				Feet.	*Tons.*	
1884 *						
1885	†18,000					
1886	23,500					
1887 ‡						
1888	27,500					
1889	31,365	$233,090	582	6–11		2,030
1890	42,068	389,435	444	6–12	50–450	2,500
1891	58,983	458,620	495	6–12	50–450	2,800
1892	52,453	377,093	482	6–12	50–456	2,100
1893	54,575	169,035	208	6–12	95–350	(§)

* Nearly all hauled from Bridgeport.
† About.
‡ No record received.
§ Not reported.

The decline in amounts and values since 1891 is said to be due to the general business depression.

These freights consist mainly of coal, iron, sand, and lumber, with varying amounts of miscellaneous articles. The figures are nearly all from records kept by the harbor master of Bridgeport. The vessels

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employed were up to as great as 12 feet draft and 456 tons tonnage; the draft is the maximum now available at mean high water.

The conditions at this locality are very favorable for the large class of manufactories using considerable quantities of coal and heavy materials, which can only be received economically by water. The New York and New Haven Railroad's main line passes only a few feet from the head of navigation on Cedar Creek, and a switch runs down the shore of the harbor. The proximity of rail and water routes avoids hauling by teams, which is a prohibitive expense in many manufacturing lines. The interests concerned are mainly the interests of the city of Bridgeport, which include Black Rock within its limits. The available water front of Bridgeport harbor proper is now almost monopolized by the railroad and steamboat companies, and with exception of a similar locality on the east side of Bridgeport harbor, there is no place in the vicinity which offers the necessary facilities for receiving materials and shipping manufactured products.

It is represented that the business of this section is now increasing and will continue to do so. Four new establishments are now being opened upon the line of the channel already dredged, as follows: An asphalt company, works in process of construction; a coal yard, docks being built; a lumber yard, just about to open; and a chemical works, nearly completed.

In regard to the breakwaters upon Fairfield Bar, and in extension of Fayerweather Island, no statistics have been presented to show the amount of commerce to be benefited by it. The advantage to local commerce would not be very great, the shelter afforded being only from storms from south to southwest, in which case vessels could easily run up the harbor to a secure place. As a harbor of refuge for general commerce of Long Island Sound the place has some advantages, but the construction of a suitable harbor would be attended with very large expense; and, in my judgment, the establishment of new harbors of refuge should be considered under a general plan for such harbors as are needed on the entire sound, so that the relative convenience and expense of different localities could be compared.

CONCLUSION.

From the facts stated above, it is my opinion that Black Rock Harbor, Connecticut, is worthy of improvement by the General Government, so far as relates to deepening, widening, extending, and protecting the existing channel.

For the purpose of preparing plans for work and estimates of cost, the maps of surveys and observations made during the progress of the completed improvement are sufficient, and no survey is required.

Appended is a copy of a letter received from several interested parties relating to this matter.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

LETTER FROM THE PRESIDENT OF THE BRIDGEPORT BOARD OF TRADE AND OTHERS, RECEIVED SEPTEMBER 7, 1894.

DEAR SIR: When you were here the other day making a survey of Black Rock Harbor, properly called West Bridgeport, you seemed anxious to know what would be the benefit of the Government taking this step in further improvements.

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We would say that when we appeared before the committee at Washington, on April 4, 1884, for our first project, there was simply no commerce done on this stream. Our first report to you of the statistics given for this locality on August 1, 1884, was 7,882 tons of coal, 900 tons of miscellaneous freight, and 5,500 feet of lumber, amounting to $50,353. Now, when you take into consideration our last report to you before this depression which was all over the country, affecting us as well as others, the valuation of raw material passing up this stream amounted to nearly $400,000. Since the first project was commenced, among the number, we have located on this stream one of the largest forgers of heavy shafting and other heavy ironwork there is anywhere in this vicinity, also the copper company and the rolling mill. All these have located on this stream and have opened since the first project was started. You can readily see that by giving us facilities so that we can conduct our business in larger vessels of larger tonnage the increase of business would amount to nearly one-third, if not one-half, more than it is at the present time, or before the depression at least. The rolling mill, in particular, wants to import their steel direct from Europe, but it is an utter impossibility owing to the depth of water, and it gives them a great deal of extra expense of reshipment from New York. Then, again, you take the Bridgeport Malleable Iron Company, which is within a few feet of the head of navigation on Cedar Creek, and say that they will have from 25,000 to 30,000 tons of coal and iron which now has to be unloaded and carted from Bridgeport, which is about a mile and a half, at an enormous expense.

In speaking of the growth of the city of Bridgeport, you will find by looking on your map of the city that west of Park avenue and near this locality there is to-day more population than there was in Bridgeport proper in 1855. To show to you the rapidity of the growth in population, in 1852 the population was 13 per cent of Fairfield County; in 1888 it was 31 per cent. Our custom-house statistics for the city of Bridgeport show that there was collected from July 1, 1887, to July 31 of the same year $7,384.39, and the year before the depression it amounted to over $100,000 collected from duties at our custom-house; so you will readily see that the improvements which you have given us in Black Rock or West Bridgeport have been duly appreciated, and it has been the cause of not only facilitating the business in this locality but it has been the means of this immense growth of population which we showed you when you were in Bridgeport.

We stated to you our idea of what we ought to have in the way of improvements, which was 12 feet of water from Long Island Sound to the head of navigation, and also, if possible, to take off the north point of Fayerweathers Island opposite the dock of Mr. Fancher, so that we could pass this point with safety when vessels were lying alongside of the wharf, and also a jetty below this point to keep the sand from washing up opposite these docks, causing a filling in of the channel.

THE WILMOT & HOBBS MANUFACTURING COMPANY.
FRANK A. WILMOT, *Secretary.*
THE BRIDGEPORT COPPER COMPANY.
JNO. H. MATTHEWS, *Secretary and Treasurer.*
THE BRIDGEPORT FORGE COMPANY.
THOS. HALLEN, *Secretary.*
JOHN MCNEIL, *President of Board of Trade.*
THE BRIDGEPORT MALLEABLE IRON COMPANY.
WM. A. GRIFFIN, *Treasurer.*
WALTER GODDARD, *Collector of Customs.*
By WALLACE A. SMITH, *Special Deputy Collector.*

Lieut. Col. HENRY M. ROBERT,
Corps of Engineers, U. S. A.

D 29.

PRELIMINARY EXAMINATION OF GREENWICH HARBOR, CONNECTICUT.

[Printed in House Ex. Doc. No. 25, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1894.

SIR: I have the honor to submit the accompanying copy of report of November 26, 1894, by Lieut. Col. Henry M. Robert, Corps of Engineers, upon preliminary examination of Greenwich Harbor, Connecticut, provided for by river and harbor act of August 17, 1894.

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Colonel Robert reports that, for the reasons stated in the report of his assistant, he considers Greenwich Harbor worthy of improvement by the General Government, and in this opinion I concur.

It is estimated that $250 will be required to make the necessary survey for the preparation of project and estimate of cost of improvement.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF LIEUT. COL. H. M. ROBERT, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., November 26, 1894.

GENERAL: I have the honor to submit herewith the following report of the preliminary examination of Greenwich Harbor, Connecticut, made in pursuance of the river and harbor act of August 17, 1894.

First Lieut. Wm. E. Craighill, Corps of Engineers, was detailed to make the preliminary examination, and his report is appended hereto.

For the reasons stated by Lieutenant Craighill, I consider Greenwich Harbor, Connecticut, worthy of improvement by the General Government, and recommend a survey of it.

The amount required to make the survey and report, with project and estimate of cost of improvement, is $250.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

REPORT OF LIEUT. W. E. CRAIGHILL, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., November 21, 1894.

COLONEL: I have the honor to submit the following report of a preliminary examination of Greenwich Harbor, Connecticut, made under your direction in October, 1894:

Greenwich is situated on the north shore of Long Island Sound, about 32 miles from New York City. It is on the line of the New York, New Haven and Hartford Railroad. Its harbor is a tidal basin with no fresh-water stream of appreciable size flowing into it. The part of it available for purposes of navigation is about half a mile long and of an average width of about 1,000 feet. At low water the upper part of the harbor is entirely bare. One small steamboat runs three times a week to New York, and a considerable business is done by means of canal boats, barges, and sailing vessels, bringing in coal, wood, timber, lumber, bricks, broken stone, and other materials of a similar kind. The steamboat, drawing 6½ feet, makes her landing near the lower end of the harbor, making her trips without regard to the tide, but with difficulty. The rest of the business is done by bringing the vessels in at high tide and allowing them to lie in the mud while unloading.

As the available depth at ordinary high tide in the upper half of the harbor is not more than 6 feet, boats can not load to their full capacity, and generally have difficulty in getting to their docks to unload.

Persons engaged in business directly dependent upon navigation are as follows:

Capt. Charles H. Holmes, running a small propeller three times weekly to pier 41, East River, New York. This boat runs all the year and four times a week in summer. If the channel were improved so as to permit it, he would put on a larger boat, fitted to carry passengers, and would make daily trips.

Smith & Maher, coal, wood, etc.

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Brush, Banks & Mead, coal, lumber, timber, etc.
William Teed, coal.
Union Gas and Stove Company, iron foundry.

All these firms have their places of business in a line on the eastern side of the harbor. The western front is unoccupied for business purposes, the promontory, of which it forms one side, being devoted to handsome summer cottages, owned generally by men from New York.

The improvement desired is the excavation of a channel from deep water of the Sound and along the front of the docks to the causeway which crosses the inlet, about 300 yards below the railroad bridge. The length of the cut would be about 5,000 feet for a width of 90 feet and a depth of 9 feet to the lower docks and 6 feet for the remainder; a rough estimate of the cost would be $20,000. It is thought the excavation would be in soft mud entirely.

The business of the place is estimated at $985,000 per annum. I am of the opinion that this harbor is one that is worthy of improvement by the General Government, for the reason that business already present is sufficient to justify the expectation that under better conditions it would increase in an amount sufficient to prove the money expended on the channel a profitable investment.

A survey is necessary to determine accurately the extent and cost of the work that should be done. To defray the expense of the survey $250 will be sufficient.

Appended are extracts from letters bearing upon the importance of the desired work.

Very respectfully, your obedient servant,

W. E. CRAIGHILL,
First Lieutenant, Corps of Engineers.

Lieut. Col. HENRY M. ROBERT,
Corps of Engineers.

[Extract from letter of Mr. W. J. Smith, of Greenwich, Conn., dated August 27, 1894.]

* * * * * * *

The materials, supplies, and products which now come to our harbor during the year may be safely estimated as follows:

Coal	tons..		15,000
General lumber	feet..	5,000,000 to	7,000,000
Timber	do...		5,000,000
Brick			10,000,000
Sand, etc	yards..		10,000
Gravel and trap rock	do...	15,000 to	20,000
Lime and cement	barrels...	50,000 to	75,000
Oats, feed, grain, etc	bags..		500,000
Quarried stone, etc	yards..	5,000 to	10,000

besides such other merchandise as is naturally received and not specified.

The crop of apples in this vicinity is larger than it has been for many years. Last week the *Maid of Kent* carried over 1,600 barrels to the city.

A steamer that carries about 250 tons makes daily trips between here and New York, carrying merchandise and passengers, for four months, and three trips a week during the remainder of the year. There are sent out from this place farm produce, etc., amounting to at least 20,000 barrels. There are many consignments in and out, of which it is impossible to form an estimate.

* * * * * * *

[Extract from letter of Mr. C. H. Holmes, of Greenwich, Conn., dated October 22, 1894.]

* * * * * * *

I hand you herewith an estimate, made up after careful consideration, of the values of cargoes of all sorts floated in Greenwich Harbor in a year:

Propeller *Maid of Kent*, general merchandise	$2,000,000
Lower dock, brick, stone, lumber, etc	150,000
Foundry dock, iron, stoves, coal, etc	250,000
Banks, Brush & Mead, at two docks and upper yard, coal, lumber, cement, brick, stone, etc	225,000
Alice I. Teed, coal, brick, etc	75,000
Smith & Maher, coal, brick, etc	100,000
Wellstood dock, brick, stone, sand, etc	25,000
Mansion House dock, brick, stone, sand, etc	10,000
Total	2,835,000

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D 30.

PRELIMINARY EXAMINATION OF BYRAM HARBOR, CONNECTICUT.

[Printed in House Ex. Doc. No. 23, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1894.

SIR: I have the honor to submit the accompanying copy of report of November 26, 1894, by Lieut. Col. Henry M. Robert, Corps of Engineers, upon preliminary examination of Byram Harbor, Connecticut, required by river and harbor act of August 17, 1894.

Colonel Robert reports that he considers this harbor worthy of improvement by the General Government, and I concur in the opinion expressed by him.

The necessary survey for the preparation of plan and estimate of cost of improvement may be made for $250.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF LIEUT. COL. H. M. ROBERT, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., November 26, 1894.

GENERAL: I have the honor to submit herewith the following report of the preliminary examination of Byram Harbor, Connecticut, made in pursuance of the river and harbor act of August 17, 1894:

First Lieut. William E. Craighill, Corps of Engineers, was detailed to make the preliminary examination, and his report is appended hereto.

For the reasons stated by Lieutenant Craighill I consider Byram Harbor, Connecticut, worthy of improvement by the General Government, and recommend a survey of it.

The amount required to make the survey and report, with project and estimate of cost of improvement, is $250.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

REPORT OF LIEUT. W. E. CRAIGHILL, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., November 21, 1894.

COLONEL: I have the honor to submit the following report of a preliminary examination of Byram Harbor, Connecticut, made under your direction in October, 1894:

This harbor is situated on the north shore of Long Island Sound about 30 miles from New York, about 2 miles in a direct line to the eastward of the Byram River, which near its mouth forms the boundary between the States of New York and Connecticut. It is a tidal basin with a very small fresh-water stream flowing into it. The mean range of tide is about 7 feet. There is no town situated immediately upon it, its business being entirely that of the stone quarries. These are owned by Geo.

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H. Ritch & Bros., Thos. Ritch & Sons, and John Voorhis. The stone gotten out is a gneiss adapted to heavy buildings. The waste is disposed of for various purposes, as, for example, the foundation for Telford roads, and some stone is crushed and shipped for road metal or concrete. The quarries are old ones, some having been in operation for many years. It is of interest to note in this connection that stone was furnished by Mr. Voorhis from his quarry for Fort Schuyler, Fort Tompkins, and the fort at Sandy Hook.

Practically all the stone quarried is shipped by water in sailing vessels. These make their way to the docks at high water and lie in the mud while loading, going out again at high water. All that part of the harbor opposite the quarries is bare at low water. As a consequence there is much delay in shipments, and vessels engaged in the business are necessarily of light draft.

What is desired for the improvement of the harbor is the excavation of a channel to and along the front of the docks, so as to give a depth of 6 feet at mean low water. If this channel is made 100 feet wide it would answer the needs of the place for the present.

Assuming that no rock is found above the depths to which the dredging is to be carried, a rough estimate of the cost of excavating a channel to the lowest dock would be $10,000 and of carrying it to the head of navigation about $10,000 more.

During the last three years the annual business from the harbor has averaged 32,000 tons of stone, valued at $96,000. As a business enterprise, I am of the opinion that this harbor is worthy of improvement. The interests directly involved are limited and private in their nature, but the Government is largely a purchaser of stone, the material exported from this harbor, and therefore is interested in an improvement that would tend to lower the price of this material in this neighborhood. On this account I consider Byram Harbor worthy of improvement by the Government.

A detailed survey should be made, not only to determine the amount and cost of the work, but also as the basis for deciding whether or not a part of the channel at the docks should not be more properly done at the expense of the parties directly interested. The cost of this survey would be $250.

Appended are extracts from letters bearing upon the importance of the desired work.

Very respectfully, your obedient servant,

W. E. CRAIGHILL,
First Lieutenant, Corps of Engineers.

Lieut. Col. HENRY M. ROBERT,
Corps of Engineers.

[Extract from letter of Messrs. Thos. Ritch & Son, Greenwich stone quarries, dated October 27, 1894.]

* * * * * * *

Our annual business approximately from our Greenwich quarries, Byram Harbor, Connecticut, was, for the years 1891, 1892, and 1893, 42,000 gross tons. We are very much in favor of your having our harbor dredged and hope you will be successful in doing so.

We have two quarries, an upper and lower quarry, from which we ship about an equal amount each year, and we would like to have the dredging go to the upper end of our upper quarry.

P. S.—The approximate price of the above quantities would be $3 per gross ton, which shows our annual business of $42,000 worth of stone, all of which is delivered by vessel from our quarries.

* * * * * * *

[Extract from letter of Mr. John Voorhis, Greenwich stone quarries, dated New York, October 31, 1894.]

* * * * * * *

In compliance with your request I herewith submit the following statement of the approximate amount of stone shipped from my quarries at Byram Harbor, Connecticut:

	Gross tons.
1891	25,000
1892	18,000
1893	11,000

Average price per gross ton, $3.

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D 31.

PRELIMINARY EXAMINATION OF PORT CHESTER HARBOR, NEW YORK.

[Printed in House Ex. Doc No. 45 Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1894.

SIR: I have the honor to submit the accompanying copy of report of October 26, 1894, by Lieut. Col. Henry M. Robert, Corps of Engineers, giving results of the preliminary examination of Port Chester Harbor, New York, provided for by river and harbor act of August 17, 1894.

Colonel Robert reports that appropriations amounting to $47,000 have already been made for this locality, and that, in his judgment, the harbor is worthy of further improvement by the United States with the object of deepening and widening the channel. I concur in the opinion of Colonel Robert.

No survey is necessary for the purpose of preparing plans and estimates of cost of the desired improvement, as sufficient information is already at hand.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF LIEUT. COL. H. M. ROBERT, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., October 26, 1894.

GENERAL: I have the honor to submit the following report upon the preliminary examination of Port Chester Harbor, New York, made in pursuance of the river and harbor act of August 17, 1894.

This harbor consists of the lower or tidal part of the Byram River and of a bay at its mouth opening into Long Island Sound. The river for about 1½ miles from its mouth forms the boundary line between the States of New York and Connecticut. A little more than a mile above its mouth the river is crossed by a highway bridge without a draw, and a short distance above this bridge is an old tide dam. The natural depth at the entrance of the harbor is about 13 feet at mean low water, which within a quarter of a mile shoals to 4 feet, and the natural available depth to the wharves at Port Chester was originally about 1 foot. The mean rise of tide is 7.4 feet.

Salt Rock, in the river channel rather more than half a mile above the mouth of the harbor, was bare at low water and was a dangerous obstruction. Sunken Rock, at the north side of the entrance channel, with 5.7 feet low-water depth, was dangerous because it was not marked. There are several other rocks between the harbor and the open sound, which, however, could be easily avoided if buoyed.

A survey of the harbor was made in 1871 and a project for improvement based upon it was submitted and adopted. It provided for the removal of the two rocks above mentioned—Sunken Rock to a depth of 11 feet below mean low water and Salt Rock to 9 feet. It also provided

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for a breakwater at Byram Point to be 400 feet long. The estimated cost was as follows:

Sunken Rock, 1,474.5 cubic yards, at $40	$58, [illegible]
Salt Rock, 316.3 cubic yards, at $40	12, 6[illegible]
Breakwater at Byram Point	25, 0[illegible]
Total	96, 6[illegible]

Under this project Salt Rock was removed in 1873. No further work was done until 1884, when a survey of the channel was made under the appropriation of August 2, 1882, and a project for expending the funds available in 1884 (about $16,000) was submitted and approved. It provided for making a channel from 60 to 100 feet wide and 2½ feet deep at mean low water from the bay to the vicinity of the bridge at Port Chester. The channel was completed to within 150 feet of the bridge in May, 1885.

In 1888 the project was modified to provide for extending the breakwater so as to cover Sunken Rock and building up the outer end to serve as a beacon, thus effectually preventing vessels from striking the rock, and leaving an open channel of over 9 feet depth at mean low water and rather more than 250 feet wide, reducing the estimate of cost, but reserving about $15,000 for maintenance and enlargement of the harbor channel. The breakwater has been completed, except some slight enlargement at the outer end, necessary to the mounting of a small harbor light. This will be completed with a part of the appropriation made by the river and harbor act of August 17, 1894.

This preliminary examination was asked for in order to present before Congress the importance of deepening the harbor channel up to the Port Chester wharves. Of the $47,000 appropriated for this harbor since 1872, about $16,000 has already been expended in dredging, and $4,000 of the available funds will be so applied this year. Undoubtedly the most important improvement which could now be made in the harbor is the further deepening and widening of the channel.

The statement of commerce by water of Port Chester Harbor, furnished for the Annual Report of 1894, shows the following business during the calendar year 1893:

Arrivals and departures of vessels.

[Draft, 5 to 10 feet; tonnage, 25 to 400 tons.]

Kind of vessels.	Number of round trips.	Aggregate tonnage of all trips.
Steamers	575	58, 500
Sailing vessels	390	28, 000
Barges	410	130, 0[illegible]
Total	1, 375	216, 5[illegible]

Freight received and shipped by water.

Chief articles.	Tons.	Estimated value.
Receipts:		
Coal, iron, lumber, stone, builders' material	99, 000	$715, 000
Miscellaneous (not otherwise included)	37, 000	975, 000
Total receipts	136, 000	1, 690, 000
Shipments:		
Farm produce, manufacturers' goods	19, 000	900, 000
Miscellaneous (not otherwise included)	8, 000	125, 000
Total shipments	27, 000	1, 025, 000

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The preceding table shows a total tonnage of freight of 163,000 tons, being a decrease of 8,000 tons since the last report received (1892), when 171,000 tons was reported. The difference is stated as due to the general business depression during the past year.

The following table shows the reported tonnage of freights received and shipped by water for the last six years:

	Tons.		Tons.
1888	102,000	1891	171,000
1889	145,000	1892	(*)
1890	160,000	1893	163,000

* No report received.

No complete records of harbor traffic are kept at Port Chester, but these figures are as accurate as can be obtained.

Port Chester has a steamboat line making three round trips weekly between that village and New York City. The boat can enter and leave the harbor only when the tide is nearly high, which prevents carrying passengers, and is a material interference with carrying perishable freight.

In my judgment, and for the reasons shown, Port Chester Harbor is worthy of further improvement by the United States, with the object of deepening and widening the channel.

For the purpose of preparing plans and estimates of cost of the desired improvement no survey is necessary, surveys made in connection with the improvements now nearly completed affording all essential information.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

D 32.

PRELIMINARY EXAMINATION OF MILTON HARBOR, AT MILTON POINT, NEW YORK.

[Printed in House Ex. Doc. No. 28, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1894.

SIR: I have the honor to submit the accompanying copy of report of November 26, 1894, by Lieut. Col. Henry M. Robert, Corps of Engineers, upon preliminary examination of Milton Harbor, at Milton Point, New York, made to comply with the requirements of the river and harbor act of August 17, 1894.

I concur in the opinion of Colonel Robert that Milton Harbor is not worthy of improvement by the General Government.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

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REPORT OF LIEUT. COL. H. M. ROBERT, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., November 26, 1894.

GENERAL: I have the honor to submit herewith the following report of the preliminary examination of Milton Harbor, at Milton Point, New York, made in pursuance of the river and harbor act of August 17, 1894.

First Lieut. William E. Craighill, Corps of Engineers, was detailed to make the preliminary examination, and his report is appended hereto.

For the reason given by Lieutenant Craighill I do not consider that Milton Harbor, at Milton Point, New York, is worthy of improvement by the General Government.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

REPORT OF FIRST LIEUT. W. E. CRAIGHILL, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., November 21, 1894.

COLONEL: I have the honor to submit the following report of a preliminary examination of Milton Harbor, at Milton Point, New York, made under your direction in October, 1894.

Milton Harbor is on the north shore of Long Island Sound, about 25 miles from New York. The total area of the inlet is included in a space about 1¼ miles long by one-fourth mile wide, but only the lower part of this is used for the purposes of navigation.

Milton Point, which forms the eastern boundary of the harbor, is about 3 miles from the New York, New Haven and Hartford Railroad, the nearest station being Rye. On this point is situated the clubhouse of the American Yacht Club Above the club dock there is a public dock, at which some business is done, a statement of which I have not been able to obtain. The harbor is said to afford an excellent anchoring ground for vessels of light draft during the worst storms on the Sound.

The improvement desired consists in digging a channel to give a depth of 12 feet at low water to the town dock. For a channel width of 100 feet the total amount to be excavated would be about 75,000 cubic yards, estimated to cost about $15,000.

The commerce of the place at present is not sufficient to warrant the expenditure of this amount of money.

For this reason I do not consider the harbor worthy of improvement by the Government.

Very respectfully, your obedient servant,

WM. E. CRAIGHILL,
First Lieut., Corps of Engineers.

Lieut. Col. HENRY M. ROBERT,
Corps of Engineers.

D 33.

PRELIMINARY EXAMINATION OF ECHO BAY AND NEW ROCHELLE HARBOR, NEW YORK.

[Printed in House Ex. Doc. No. 38, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1894.

SIR: I have the honor to submit the accompanying copy of report of November 24, 1894, by Lieut. Col. Henry M. Robert, Corps of Engineers, upon preliminary examination of Echo Bay and New Rochelle Harbor,

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New York, made in accordance with the provisions of the river and harbor act of August 17, 1894.

Colonel Robert reports that he does not consider this locality worthy of improvement by the General Government, and in this opinion I concur.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF LIEUT. COL. H. M. ROBERT, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., November 24, 1894.

GENERAL: I have the honor to submit herewith the following report of the preliminary examination of Echo Bay and New Rochelle Harbor, New York, made in pursuance of the river and harbor act of August 17, 1894.

First Lieut. William E. Craighill, Corps of Engineers, was detailed to make the preliminary examination, and his report is appended hereto.

For the reasons given by Lieutenant Craighill I do not consider that Echo Bay and New Rochelle Harbor, New York, are worthy of improvement by the General Government.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

REPORT OF FIRST LIEUT. W. E. CRAIGHILL, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., November 17, 1894.

COLONEL: I have the honor to submit the following report of a preliminary examination of Echo Bay and New Rochelle Harbor, made under your direction in October, 1894:

The town of New Rochelle is situated near the west end of Long Island Sound; has two points of access to the Sound, the one at New Rochelle Harbor, so called, the other at Echo Bay.

New Rochelle Harbor is a narrow, circuitous passage, having an original depth in the main channel of from 8 to 9 feet at mean low water. It is principally used by the excursion steamers to Glen Island. Besides, it affords access to a landing place for the quartermaster's steamer from the post of Davids Island, and an anchoring ground for a few small pleasure craft.

Appropriations for the improvement of this harbor have been made as follows:

March 3, 1881	$20,000
August 2, 1882	15,000
Total	35,000

Colonel Houston, in his annual report for 1891 (Part I, p. 804, Report of Chief of Engineers, 1891), states as follows:

"The project for improvement is practically completed, except the removal of Rock C. This does not now appear to be necessary, therefore no further work is now proposed."

Under the present conditions this harbor is not worthy of further improvement by the General Government.

Echo Bay is now used as the commercial harbor of New Rochelle. It was surveyed in 1875, under the direction of Lieutenant-Colonel Newton, and reported upon by him in his annual report for 1876 (see Annual Report, Chief of Engineers, Part I, p. 263).

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Appropriations for the improvement of the harbor have been made as follows:

June 18, 1878	$10,000
March 3, 1879	3,000
June 14, 1880	3,000
March 3, 1881	3,000
August 2, 1882	3,000
Total	22,000

In the original report on Echo Bay, by Lieutenant-Colonel Newton, it was stated: "The improvement for the benefit of navigation would consist in the removal and marking of certain dangerous rocky obstructions."

Start Rock and Sheepshead Reef were mentioned as "the two most dangerous obstructions." Start Rock has since been removed, as well as a portion of Sheepshead Reef.

The improvement now desired is the removal of the remainder of this reef.

The reef was originally estimated to contain 872.5 cubic yards, and it was stated in Colonel Houston's report for 1891 (Annual Report, Chief of Engineers, Part I, p. 803, 1891) that 506 cubic yards had been removed. The part of the reef remaining would then appear to contain the difference between these figures, or 366.5 cubic yards.

My estimate for the removal of this amount would be as follows:

366.5 cubic yards, at $15	$5,497.50
Contingencies, 15 per cent	824.62
	6,322 12

This estimate is necessarily approximate only in advance of a survey to determine definitely the amount of rock remaining to be removed.

There are also some isolated points of rock in various parts of the harbor which it would be advantageous to remove. These are principally Devoes Rock and some fragments that seem to have been left after the work on Start Rock. The expense would be small.

The town of New Rochelle was stated to me to have a population of 11,000, having grown to this extent from 4,000 since 1886. Its commerce by water, through Echo Bay, consists of one freight steamboat per day to New York, and occasional vessels bringing lumber, coal, brick, stone, etc. Besides, on an average of about once a week during the summer, excursion steamers come to the dock, and the bay is much used as an anchoring ground for yachts.

Vessels drawing 7 feet can go to the public dock at low tide, and yachts drawing as much as 12 feet anchor in the harbor. The channel to the upper end of the harbor has been improved to a width of 40 feet and depth of 4 feet at low water.

Maps of the harbor will be found in the reports of the Chief of Engineers, 1880, page 513, and 1886, page 654. I have not been able to obtain a statement of the commerce of the place.

For the reasons that the present condition of the channel appears to be all that is needed for the commerce of the place, and that the enlargement of the anchoring ground would not be sufficient to justify the expenditure of the amount required, I do not consider Echo Bay as worthy of improvement by the Government.

Very respectfully, your obedient servant,

W. E. CRAIGHILL,
First Lieutenant, Corps of Engineers.

Lieut. Col. HENRY M. ROBERT,
Corps of Engineers.

D 34.

PRELIMINARY EXAMINATION OF HARBOR OF GREENPORT, NEW YORK.

[Printed in House Ex. Doc. No. 44, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1894.

SIR: I have the honor to submit the accompanying copy of report, dated October 26, 1894, by Lieut. Col. H. M. Robert, Corps of Engineers, giving results of preliminary examination of harbor of Greenport, N. Y., ordered by river and harbor act of August 17, 1894.

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A project for the improvement of the harbor by the General Government was completed in 1893, but in the opinion of Colonel Robert this locality is worthy of further improvement by the United States, with the object in view of deepening the anchorage ground in Sterling Basin and widening and deepening its approaches; and in this opinion I concur.

No survey is necessary for the purpose of preparing plans and estimates of cost of the desired improvement, the surveys already made affording all essential information.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF LIEUT. COL. H. M. ROBERT, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., October 26, 1894.

GENERAL: I have the honor to submit the following report upon the preliminary examination of the harbor of Greenport, N. Y., made in pursuance of the river and harbor act of August 17, 1894:

Greenport Harbor is a small anchorage ground on the southeast side of the north fork of Long Island, near its eastern end. It is a part of Shelter Island Sound, a crooked and rather deep channel, which, with Shelter Island, separates the two forks of Long Island. Greenport Harbor consists of a small bay, originally exposed to northeast storms, but now sheltered by a breakwater, and of a land-locked shallow anchorage with narrow entrance, known as Sterling Basin. The mean rise of tide at Greenport Harbor is 2.4 feet.

A survey of Greenport Harbor was ordered by Congress in 1881, and in the report upon this, dated January 20, 1882, and printed in the Annual Report of the Chief of Engineers for 1882, Part I, page 635, a project was submitted for a breakwater to shelter the anchorage ground and to check further erosion of Joshuas Point. This project, adopted in 1882, contemplated a breakwater about 1,700 feet long, the top to be 5 feet wide and 3 feet above mean high-water level, at an estimated cost of $46,000. In 1890, when the breakwater had been made 1,570 feet long, the project was modified to provide for increasing its height to 5 feet above mean high water, to omit the further extension, and to apply the remainder of the estimate, for completion, to dredging in order to increase the area of sheltered anchorage. The project was completed in 1893, the available area of sheltered anchorage having been enlarged by about 2 acres, and the entrance to Sterling Basin having been widened and deepened.

Harbor lines for Greenport Harbor were established by the Secretary of War January 5, 1894.

This preliminary examination was asked in order to bring to the attention of Congress the importance of deepening the anchorage area in Sterling Basin within the established harbor lines.

The freight annually received at Greenport by water has been estimated at different times since 1882 at from 20,000 to 43,500 tons; these have been admittedly incomplete, but as no records of commerce are kept they were accepted as the best attainable. A much more careful

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and detailed statement was prepared for the calendar year 1893, showing the total of receipts and shipments to have been 158,310 tons, which is believed to be quite accurate. A copy of it is attached to this report.

The improvement now desired would benefit, only in a general way, that commerce which consists in receiving and forwarding freight. It is desired primarily in order to provide a place where yachts, fishing steamers, and small sailing vessels can lie up during winter in safety and be ready and convenient for overhauling, repairing, and fitting out in spring. It would also be used as a harbor of refuge.

The business of fitting out and repairing pleasure boats and small steamers has already reached considerable proportions in Greenport, 325 vessels having been repaired on the marine railways during 1893, and it is said to be increasing, notwithstanding the inadequacy of the basin for winter quarters. The bottom is soft and vessels that can get into the basin at high tide can lie aground there without injury.

No records have been kept of the extent to which this basin has been used for winter quarters for vessels. It is estimated that about 50 were quartered there last winter. It is reported that, by actual count, 45 boats were in the basin October 14, 1894, as follows:

Vessels.	Number.	Draft.
		Feet.
Steamers	2	3½ to 5½
Schooners	6	5 to 6½
Sloops	25	3 to 6½
Smaller sailboats	12	2 to 3½
Total	45	

There is no doubt that it would be used to much greater extent if the depths were sufficient.

The fact that successive Congresses have made appropriations for improving this harbor shows that it has been regarded as worthy of improvement heretofore. In my opinion Greenport Harbor is worthy of further improvement by the United States, with the object stated; that is, deepening the anchorage ground in Sterling Basin and widening and deepening its approaches. For the purpose of preparing plans and estimates of cost of the desired improvement no survey is necessary, the surveys made during the progress of the improvements completed in 1893 affording all essential information.

Inclosed herewith is a statement in relation to the desired improvement, presented by Hon. Henry A. Reeves, of Greenport, and containing details of the commerce of Greenport during the calendar year 1893.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Lieut. Col, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

STATEMENT RELATING TO THE DESIRED IMPROVEMENT, PRESENTED BY HON. HENRY A. REEVES, OF GREENPORT, N. Y.

The principal object for which the proposed further improvement of Greenport Harbor is sought is to establish thereat a safe, accessible, and convenient inner harbor, available especially for the use of yachts and vessels of light draft, within which to anchor during storms or periods of inactivity, and to "lay up" during the winter season.

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Practically, the work already done, while of the greatest importance and value, commercially speaking, has served to protect the harbor from encroachments by easterly storms, and to afford an improved waterway on the west side of the breakwater. It is now desired to supplement this improvement by extending the channel, which has been deepened and widened up to and into the mouth of Sterling Basin or creek, within the basin, and to convert the main space of the basin into a harbor by dredging to a sufficient depth over an area of about 1,200 feet by 600 feet.

The natural conditions for the success of such an undertaking are regarded as favorable in an unusual degree. The basin is entirely landlocked and secure; the bottom is of soft mud, admitting of easy dredging; the distance to deep water, wherein the dredgings can be effectually and completely disposed of without harm to navigation, is not inconveniently great; the space so obtained by simple dredging could be easily and quickly reached from the outer harbor, now that the channel has been straightened and widened, and would accommodate a larger number of boats of the class referred to, for which there is now no adequate or convenient provision.

The harbor of Greenport, in a general sense, as to depth of water, area, security from storms, and freedom from ice, may be said to be one of the important harbors of the Atlantic Seaboard; but its location on the extreme eastern end of an island precludes its obtaining the same measure of general commerce which its actual advantages would otherwise command. It at one time, forty years ago and more, had a very considerable share of the whale fishery; when that ceased to be profitable and was given up, it became the home port of a large number of the superior wooden coasting vessels, mostly two and three masted schooners, which flourished for twenty or twenty-five years, until steam supplanted them; and now its principal business is done in the line of fishing steamers and smacks, and of comparatively small craft, sloops, and schooners, engaged in local commerce, whose development, while steadily progressive, is slow. Within a few years past yachts, both steam and sail, have resorted to this harbor in increasing numbers, and from early spring to late fall they are seen on the adjacent bays, making their headquarters at Greenport. Their owners and sailing masters say that if there were a safe and comfortable place in which to lay up these costly craft at this harbor, they would be glad to do so.

It is to accommodate them and the large class of other light-draft vessels, which are generally idle for three or four months of winter and which need increased room and safer winter quarters than they can always find available, that this improvement of Sterling Basin is especially desired. If effected, its results in the way of promoting the commercial and the material interests of Greenport and its vicinity would be certain and extensive, affecting the whole community, besides lending impetus to the local development of commerce on Peconic and Gardiners bays. In view of the foregoing statement, which is believed to be a moderate one, much below the claims that might be urged, I respectfully submit that the proposed improvement is fully justified by the facts and conditions of the case, and can not fail to yield a lasting return of benefit to general and local commerce far greater than any probable cost.

As showing the present actual importance, in a commercial sense, of the harbor of Greenport, I am supplied with the following statistics for the year 1893, taken from official records or carefully compiled and believed to be entirely reliable:

HARBOR OF GREENPORT, LONG ISLAND, NEW YORK, FOR YEAR 1893.

Arrivals and departures of vessels.

[Draft, 3 to 18 feet; tonnage, 5 to 1,200 tons.]

Kind of vessels:	
Steamers	34
Sailing vessels	191
Barges, yachts	300
Total	525

Number of round trips.	Aggregate tonnage, all trips.
	Tons.
Four steamers, daily trips	1,623
Thirty steamers, weekly trips	2,951
One trip per week	8,319
Two trips per year	22,500
Total	35,393

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Freight received and shipped by water.

RECEIPTS.

Chief articles.	Tons.	Estimated value.
Coal	12,000	$60,000
Ship timber and lumber	2,426	45,480
Stone	1,500	2,250
Salt	600	3,960
Wood	750	1,500
Freight landed by steamers	15,000	.....
Fish (in boxes), phosphates, railroad ties, lumber, ice, etc., landed at railroad wharf	89,704	.....
Total	121,980	.....

SHIPMENTS.

Chief articles.	Tons.	Value.
Sand	3,000	$4,500
Wood	1,500	12,000
Brick	20,000	140,000
Shells	8,000	32,000
Oysters	480	12,000
Clams	350	10,000
Fish	1,500	120,000
Produce	1,500	35,000
Total	36,330	.....

Number of vessels entered for refuge in 1893 (estimated) 525
Number of vessels repaired on marine railways 325

	Number.	Tonnage.
Steam vessels enrolled at this port	30	2,951.48
Sail vessels enrolled at this port	191	8,319.49
Barges enrolled at this port	1	781.30
Total	222	12,052.27

D 35.

PRELIMINARY EXAMINATION OF COLD SPRING HARBOR, NEW YORK.

[Printed in House Ex. Doc. No. 43, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1894.

SIR: I have the honor to submit the accompanying copy of report of November 28, 1894, by Lieut. Col. Henry M. Robert, Corps of Engineers, upon preliminary examination of Cold Spring Harbor, New York, provided for by the river and harbor act of August 17, 1894.

Colonel Robert reports that, for the reasons stated by his assistant, he does not consider Cold Spring Harbor worthy of improvement by the Government.

I concur in the opinion expressed by Colonel Robert.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. DANIEL S. LAMONT,
Secretary of War.

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REPORT OF LIEUT. COL. H. M. ROBERT, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., November 28, 1894.

GENERAL: I have the honor to forward herewith a report of a preliminary examination of Cold Spring Harbor, New York, made by First Lieut. William E. Craighill, Corps of Engineers, in pursuance of the river and harbor act of August 17, 1894.

For the reasons stated by Lieutenant Craighill, I do not consider Cold Spring Harbor, New York, worthy of improvement by the Government.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

REPORT OF FIRST LIEUT. W. E. CRAIGHILL, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., November 22, 1894.

COLONEL: I have the honor to submit the following report of a preliminary examination of Cold Spring Harbor, New York, made under your direction in October, 1894:

This harbor is at the head of Oyster Bay, on the north shore of Long Island, situated about 35 miles from New York. The outer harbor has an abundance of sufficiently deep water. The inner harbor, of about 100 acres in area, is very shoal, much of it being bare at low water, and its entrance is obstructed by a bar of sand. All the business is now done from the lower docks, about a mile below the entrance to the inner harbor.

The desired improvement consists in cutting a channel from deep water of the outer bay to the docks of the inner harbor to the biological laboratory of the Brooklyn Institute of Arts and Sciences and to the building of the New York State Fish Commission. The two institutions last named are, from their nature, interested in having access to the deep water of the sound. The biological laboratory belongs to the Wawepex Society, whose purpose is to promote the increase and diffusion of knowledge in the natural history sciences. The New York State Fish Hatchery gives attention to the hatching of both fresh and salt water fish and lobsters; of the two latter many millions are annually turned out into the open waters of Long Island Sound. Both these institutions have buildings near the head of the inner harbor. Along the east side of the harbor there are several old docks, but the business done at them is at present of but small amount.

A channel 80 feet wide and 6 feet deep at low water would answer all the needs of the place. It would be about 3,600 feet long, and 70,000 cubic yards of excavation, roughly stated, would be required. This would cost about $15,000.

It is doubtful, however, whether the dredged cut through the sand bar at the mouth of the harbor would maintain itself without jetties or other permanent constructions, which would be more expensive than the present or prospective commerce of the place will justify.

I do not therefore think this harbor is worthy of improvement by the Government.

Appended are extracts from letters bearing upon the importance of the desired work.

Very respectfully, your obedient servant,

W. E. CRAIGHILL,
First Lieutenant, Corps of Engineers.

Lieut. Col. HENRY M. ROBERT,
Corps of Engineers.

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EXTRACT FROM PETITION OF JOHN B. WOODWARD, PRESIDENT, FRANKLIN W. HOOPER, DIRECTOR, OF THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES, AND EUGENE G. BLACKFORD, TREASURER OF THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES (ALSO PRESIDENT OF THE BIOLOGICAL DEPARTMENT MAINTAINING SCHOOL AT COLD SPRING HARBOR); JOHN D. JONES, PRESIDENT OF THE WAWEPEX SOCIETY, AND FOURTEEN OTHERS, DATED OCTOBER, 1894.

* * * * * * * *

In the matter of the proposed improvement of Cold Spring Harbor, Long Island, by the General Government:

The undersigned respectfully represent that the channel of approach to the inner harbor and the inner harbor have been long filling up so that the various docks situate on both sides of such inner harbor, which were formerly largely used for commercial purposes, are now rendered almost useless.

They also represent that the New York State Fish Hatchery, which gives attention to the hatching of both fresh and salt water fish and lobsters, and of the two latter many millions are annually turned out in the open waters of Long Island Sound, and the biological laboratory of the Brooklyn Institute of Arts and Sciences with students from all parts of the United States engaged in biological and other scientific research, including the study of marine animal and vegetable life, and for which object special buildings have been erected, are both located at or near the head of the inner harbor.

These two important public and semipublic institutions work somewhat in unison, and they experience great difficulty, except at high tide, in reaching their respective landings in consequence of such filling up of the channel and harbor. And their future successful operation depends largely upon the deepening of the channel so as to afford better facilities for reaching their buildings.

We therefore are of the opinion that the reasonable deepening of the channel so as to render access to the various docks and wharves on the inner harbor is a proper improvement and should be done by the General Government in view not merely of the usual commercial advantages, but of the great future benefits that will result to the public through the enlarged operation of the two institutions above mentioned, now well established.

* * * * * * * *

EXTRACT FROM LETTER OF WILLIAM E. JONES, COLD SPRING HARBOR, LONG ISLAND, DATED OCTOBER 24, 1894.

* * * * * * * *

Complying with your request of Tuesday last, I inclose herewith a list of vessels licensed and belonging to the port of Cold Spring Harbor.

Cold Spring Harbor is a port of entry and has a little over 4,000 tons registered by its customs officer for 1894, 1,019 tons of which are owned in and belong to Cold Spring Harbor. In 1884 there were 2,428 tons and in 1874 3,220 tons owned in and belonging to Cold Spring Harbor.

In 1874 six packets were kept busy all the time taking farmers' produce on board from the docks you saw inside the sand bars and carrying them to New York City.

The present landing for the steam propeller which plies between Cold Spring and New York, on account of shallow water and mud, is 1¼ miles farther north than it should be for the accommodation of its patrons and the farmers who send produce to New York, necessitating an extra cartage of 1¼ miles each way.

There are upward of 15,000 acres of land that are dependent on Cold Spring Harbor for its nearest and cheapest water shipping point. Of this land about one-third is wood, much of which being on the hilly portion near the harbor. Another third, with the exception of fruit orchards, is about equally divided between haying and pasture lands, while the remaining third is used for raising grain to enliven the land after its hay cropping and also for raising garden vegetables (mostly pickles, cabbage, potatoes, and tomatoes) for the New York market.

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Statement of vessels licensed and belonging to the port of Cold Spring, Long Island, in the years 1874, 1884, and 1894.

* * * * * * *

1874.

Vessels.	Gross tonnage.	Vessels.	Gross tonnage.
Schooners:		Schooners—Continued.	
William L. Peck	77.81	Horizon	109 88
Temis Bodine	112.90	Francis H. Smith	125 67
Sarah Purves	165.35	Ann Dole	189.97
Eliza J. Raynor	212.61	J. H. Barnett	146.09
P. M. Wheaton	242.23	Racer	68.85
Excelsior	80.83	Evergreen	119 66
Dispatch	42.58	F. Merwin	187 52
Annie E. Derrickson	57.41	D. C. Foster	95 23
C. W. Locke	230.06	Lizzie Evans	155 45
John Warren	134.86	Sloops:	
E. & I. Oakley	171.80	Palmyra	34.76
Flyaway	139.16	E. A. Willis	33 45
Cynthia Jane	114.52	Daniel B. Smith	15.34
Reindeer	90.32		
Sarah L. Merritt	67.23	Total	3,220.94

1884.

Vessels.	Tonnage.		Vessels.	Tonnage.	
	Gross.	Net.		Gross.	Net.
Schooners:			Schooners—Continued:		
Sarah Quinn	113.68	108	Geo. Gurney	240.89	228.85
Eliza J. Raynor	212.61	201.98	Dispatch	42.58	40.46
Cynthia Jane	114.52	108.80	Flyaway	159.99	152
Rev. J. Fletcher	108.84	103.40	Sharpshooter	54.19	51.49
Allen Gurney	169.97	161.47	Sloops:		
Wm. L. Peck	77.81	73.92	E. A. Willis	33.45	31.78
John Warren	134.86	128.12	Leonida	38.34	36.43
Horizon	109.88	104.39	Nellie G	17.37	16.51
D. C. Foster	95.23	90.47	Dan'l B. Smith	15.34	14.58
Mabel Rose	388.04	368 64	Telephone	9.47	9
Evergreen	119.66	113.68			
E & I. Oakley	171.80	163.21	Total	2,428.52	.....

1894.

Schooners:			Sloops:		
Mabel Rose	388.04	368.64	Richard Mall	33.62	31.94
Horizon	109.88	104.39	S. H. Edwards	19.07	18.12
John Warren	134.86	128.12	Gray Eagle	12	11.40
Sarah Quinn	113.68	108	Ocean Wave	6.09	5.79
A. E. Derrickson	57.41	54.54	Ideal	6.63	6.30
Dispatch	42.58	40.46			
D. C. Foster	95.23	90.47	Total	1,019.09	.....

* * * * * * *

D 36.

PRELIMINARY EXAMINATION OF HEMPSTEAD HARBOR, NEW YORK.

[Printed in House Ex. Doc. No. 163, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., January 2, 1895.

SIR: I have the honor to submit the accompanying copy of report of December 31, 1894, by Lieut. Col. Henry M. Robert, Corps of Engineers, in regard to the preliminary examination of Hempstead Harbor, New York, provided for by the river and harbor act of August 17, 1894.

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Colonel Robert reports that work for the improvement of this locality is being at present carried on under appropriations made by Congress for improving Glen Cove Harbor; and, further, that he does not consider Hempstead Harbor worthy of improvement by the Government, except to the extent contemplated by the present project.

The views of Colonel Robert are concurred in by this office.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF LIEUT. COL. H. M. ROBERT, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., December 31, 1894.

GENERAL: I have the honor to submit herewith the following report upon the preliminary examination of Hempstead Harbor, New York, made in pursuance of the river and harbor act of August 17, 1894.

I have been unable to find anyone who knows the object of this examination, though I have written three letters of inquiry to the Representative of the Congressional district containing this harbor, and have personally visited several of the villages on the shore of the bay known as Hempstead Harbor. The Government is already improving this harbor, the appropriations being for Glen Cove Harbor, which is a common name for the portion of the harbor most commonly used. In fact, the name Hempstead Harbor is very misleading, as it applies to a large bay with a wide mouth on the north shore of Long Island, while the name Hempstead Bay is applied to a body of water on the south shore, almost entirely surrounded by land. I find that Hempstead Harbor is constantly referred to in reports from this office as Hempstead Bay, while the part that is being improved by a breakwater is generally called Glen Cove Harbor.

The people interested are very anxious to get larger appropriations for the breakwater, but as that work has already been sanctioned by Congress, and an appropriation was made for it in the last river and harbor act, and as it will require $146,960 more to be appropriated to complete the project, I do not consider it a proper subject for an examination or survey. I do not know of any other part of Hempstead Harbor that requires improvement by the Government.

I would therefore report that I do not consider Hempstead Harbor worthy of improvement by the Government, except to such extent as it is now being improved at Glen Cove Harbor.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

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D 37.

PRELIMINARY EXAMINATION OF WOODSBURG CHANNEL, HEMPSTEAD BAY, NEW YORK.

[Printed in House Ex. Doc. No. 68, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1894.

SIR: I have the honor to submit the accompanying copy of report of November 24, 1894, by Lieut. Col. Henry M. Robert, Corps of Engineers, upon preliminary examination of Woodsburg Channel, in Hempstead Bay, New York, made to comply with provisions of river and harbor act of August 17, 1894.

Colonel Robert reports that he does not consider Woodsburg Channel worthy of improvement, and in this opinion I concur.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF LIEUT. COL. H. M. ROBERT, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., November 24, 1894.

GENERAL: I have the honor to submit herewith the following report of the preliminary examination of Woodsburg Channel, Hempstead Bay, New York, made in pursuance of the river and harbor act of August 17, 1894.

First Lieut. William E. Craighill, Corps of Engineers, was detailed to make the preliminary examination, and his report is appended hereto.

For the reasons given by Lieutenant Craighill, I do not consider that Woodsburg Channel, Hempstead Bay, New York, is worthy of improvement by the General Government.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

REPORT OF FIRST LIEUT. W. E. CRAIGHILL, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., November 16, 1894.

COLONEL: I have the honor to submit the following report of a preliminary examination of Woodsburg Channel in Hempstead Bay, New York, made under your direction in October, 1894.

Hempstead Bay is a mass of small, irregular and shallow channels, extending nearly all the way from South Oyster Bay on the east to Jamaica Bay on the west. Woodsburg Channel is in the western part of this bay.

The dock on this channel is about a mile from Woodsburg, a small suburban town near the south shore of Long Island and distant from Brooklyn about 19 miles.

The difficulty experienced is directly in the neighborhood of the dock, and is that the present low-water channel lies at some distance from the dock. It is desired to

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excavate a new channel to the dock, from the nearest deep water in the channel. To accomplish this a cut estimated at 1,000 feet in length would be necessary. It would be sufficient to make it 40 feet wide and 4 feet in depth at low water. Two thousand dollars would probably cover the cost of the work.

Little or no business is done at this point, except the shipment of oysters, which is of considerable importance, but it is hoped that if the means of access to the dock were improved the business would increase, and a check would be had upon the railroad, which now has a monopoly of the freight business for Woodsburg and the neighboring towns.

It is stated that "there was paid last year to the Long Island Railroad, by the people of Woodsburg, $9,000; by the people of Fenhurst, $9,000; by the people of Lawrence, $45,000; by the people of Cedarhurst, $12,000; by the people of Far Rockaway, $135,000. * * * There is no competing line of road, and because of the condition of the channel there are no means of bringing in or sending away freight by water; consequently, the railroad charges what it pleases and moves freight at its own sweet will."

This work would probably be of benefit to a large community now reached by only one railroad, but I think the same result could be accomplished by moving the dock to the channel, a distance of not over 200 yards, and this is more properly a subject for private enterprise.

For these reasons this channel is not, in my opinion, worthy of improvement by the General Government.

Appended to this report is copy of letter received from Hon. T. F. Magner bearing upon the importance of the desired work.

Very respectfully, your obedient servant,

W. E. CRAIGHILL,
First Lieut., Corps of Engineers.

Lieut. Col. HENRY M. ROBERT,
Corps of Engineers.

LETTER OF HON. T. F. MAGNER.

BROOKLYN, *September 10, 1894.*

MY DEAR SIR: On the 29th ultimo I received a letter from you in relation to the preliminary survey of Woodsburg Channel, in pursuance of the river and harbor act of last August. The improvement desired is the deepening of the channel at the dock at the foot of the Woodsburg boulevard leading to the railroad station. The Woodsburg Channel runs a deep-water stream from the East Rockaway Inlet nearly up to the pier at the foot of the boulevard. The improvement desired would bring this deep-water channel directly up to the pier. The pier is the only pier on this bay west of East Rockaway. It is used by the public, and has been for some time by consent of the owners. It is the only means of receiving and shipping freight, except the Long Island Railroad, in this section of the country. It is the only landing for a vessel between the landing at Inwood, on the Jamaica Bay, and the landing at East Rockaway. The people in the great strip of land between Far Rockaway and East Rockaway are compelled to depend exclusively upon the Long Island Railroad for receiving and shipping their freights. This section of the country is rapidly growing, and it is only a question of a few years when it will be closely built upon by people who are leaving the cities of New York and Brooklyn and erecting villa residences there.

The Far Rockaway branch of the Long Island Railroad earned one-sixth of all the receipts of that railroad for the past year. There was paid last year to the Long Island Railroad by the people of Woodsburg, $9,000; by the people of Fenhurst, $9,000; by the people of Lawrence, $45,000; by the people of Cedarhurst, $12,000, by the people of Far Rockaway, $135,000. All this money was spent by these people to a system of railroad which possesses a monopoly of the business and which charges rates beyond that of any other railroad in the State of New York. There is no competing line of road, and because of the conditions of the channel there is no means of bringing in or sending away freights by water, consequently the railroad charges what it pleases and moves freight at its own sweet will. Immense quantity of brick, lumber, and other brick materials are annually brought to this section from New York by rail, and tons of oysters, clams, and agricultural products are shipped in return. All of this has to be done at excessively high rates over the Long Island Railroad system. It would be of incalculable value to the people in this section of the land to have this channel brought up to the pier now used by the public, so that a sufficient depth of water might there be had for the purpose of bringing in light craft.

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During the recent few years the channel has backed away from the pier by reason of débris thrown in the bay, and these impediments have accumulated in some cases so as to appear above the water, affording an opportunity for squatters to build shipping cabins thereon. If a proper survey were made of the bay, defining the limits within which this might not be done, private enterprise would be stimulated to undertake work even if the Government engineers would deem the actual dredging too vast an undertaking to recommend. There are other facts which could only be explained by personal inspection, and these I will be pleased to put in your possession at any time it would be convenient for you to present yourself at the Woodsburg Channel. If you would inform me when you propose to visit the place I will meet you with proper conveyances and show you in person just what is desired.

With assurance of regard, I am, sincerely, yours,

THOS. F. MAGNER,
Member of Congress, Sixth District of New York.

Col. HENRY M. ROBERT.

D 38.

SURVEY OF COS COB HARBOR AND MIANUS RIVER, CONNECTICUT.

ENGINEER OFFICE, UNITED STATES ARMY,
New York City, June 19, 1895.

GENERAL: I have the honor to submit the following report on the survey of the lower part of the harbor of Cos Cob and Mianus River, Connecticut, provided for in the river and harbor act of 1894, which act contained an appropriation clause as follows:

Improving harbor at Cos Cob and Mianus River, Connecticut: Continuing improvement, four thousand dollars, including a survey of the lower part of the harbor with a view of making a turning basin therein.

The existing project for improvement of this harbor, adopted in 1892 after a survey had been ordered by Congress and the first appropriation for improvement had been made, provides for a channel 6 feet deep at mean low water up to the Mianus wharves, to be 150 feet wide below the railroad bridge and 100 feet wide above the bridge.

The original petition to Congress, printed in the Annual Report of the Chief of Engineers for 1891, page 853, asks for a channel 300 feet wide up to Mianus. After a conference between the petitioners and the engineer officer in charge they agreed that such a width would make a more expensive improvement than the existing commerce would warrant and they approved of reducing it to the limits stated in the project.

I am informed by the persons at whose request the first survey was made that it was at that time their desire to secure a considerable widening of the channel in the lower part of the harbor to serve the purpose of a turning basin, or more properly, an anchorage basin, therein. They state that owing to their lack of familiarity with the distances on water and their misunderstanding the language of the project, they had believed that the project as adopted would give them in part, if not wholly, the anchorage room which they had desired, and it was to remedy this error that they asked to have the survey ordered by Congress, so that estimates and plans for the desired anchorage area could be presented.

The survey was made in the fall of 1894, and the map of the same, showing correctly the location of the desired turning basin, is forwarded herewith.

The turning basin, as desired, would lie on the west side of the channel, just inside the entrance to the harbor, widening the channel by 300 feet, with a depth of 7 feet at mean low water, for a distance of

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about 2,000 feet measured along the channel and narrowing it to about 1,500 feet at the west side of the turning basin. To excavate this area to the required depth would involve dredging 100,000 cubic yards of material. The survey shows there would be no unusual difficulty or expense attendant upon this work. The material to be dredged would be mud, with possibly a small amount of sand near the outer end.

The excavation of this turning basin is estimated to cost as follows:

Dredging 100,000 cubic yards of material, at 15 cents per yard	$15,000
Supervision, contingencies, etc., about	3,000
Total estimated cost	18,000

If this extension of the project be adopted it would afford anchorage room in the lower harbor, where it is much needed in the summer, when the channel is often crowded with yachts and pleasure boats to such an extent as to make navigation a matter of difficulty.

The adoption of this extension would increase the cost of completion by about $18,000, making the estimate for the whole project from the beginning, in 1892, $54,000 instead of $36,000; though if appropriation was made sufficient to excavate the entire basin in one year the work could probably be done for 12 cents per cubic yard, or at a total cost of $15,000.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Colonel of Engineers.

Brig. Gen. WM. P. CRAIGHILL,
Chief of Engineers, U. S. A.

D 39.

ESTABLISHMENT OF HARBOR LINES AT NEW HAVEN, CONNECTICUT.

OFFICE OF BOARD OF HARBOR COMMISSIONERS,
New Haven, Conn., October 19, 1894.

DEAR SIR: At a recent meeting of the board of harbor commissioners for New Haven Harbor, it was resolved that a map of the harbor lines of New Haven Harbor, as prescribed by the board of harbor commissioners and established by the general assembly of Connecticut, be forwarded to Col. H. M. Robert, with request that he transmit it to the Secretary of War and recommend that the harbor lines as prescribed by the harbor commission and established by the general assembly be approved by the Secretary of War, if in his judgment they are such harbor lines as are proper and suited to the needs of New Haven Harbor.

The map referred to is sent herewith.* Will you kindly forward it to the Secretary of War, with a copy of the above resolution and with such remarks and recommendations as you feel authorized to make.

Very respectfully, yours,

A. B. HILL,
Clerk Board of Harbor Commissioners.

Lieut. Col. H. M. ROBERT,
Corps of Engineers, U. S. A.

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* Omitted.

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REPORT OF LIEUT. COL. HENRY M. ROBERT, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., November 10, 1894.

GENERAL: On October 10, 1894, the board of harbor commissioners for New Haven Harbor, Connecticut, wrote me forwarding a map and description of certain harbor lines in New Haven Harbor, established by the general assembly of the State of Connecticut, and requesting me to forward the same to the Secretary of War and to recommend their approval by him if in his judgment they are such harbor lines as are proper and suited to the needs of New Haven Harbor.

I have the honor to transmit herewith the letter, map,* and description referred to, together with a copy of the act* of the general assembly of the State of Connecticut, establishing the board of harbor commissioners and defining its authority.

Section 3 of said act is as follows:

SEC. 3. Whenever, in the judgment of said board of harbor commissioners, the public good requires, they may proceed to prescribe harbor lines in said harbor, beyond which no wharf, pier, or other structure shall be extended into said harbor, and shall report the same for the consideration of general assembly at its next session: *Provided, however,* That said commissioners, before drawing any such line, shall appoint a convenient time and place for hearing of all persons interested, and shall give notice thereof by publication two weeks successively in two or more newspapers published in the city of New Haven, the first publication to be at least twenty days before the time of hearing.

In compliance with this act the harbor commissioners in 1875, after a public hearing, of which twenty days' notice was given, adopted certain harbor lines which the State legislature enacted into a law. In 1878, 1881, and 1893 these harbor lines were in similar manner extended by acts of the legislature, as shown in inclosure B. Governor James E. English and Prof. William P. Trowbridge were members of the board of harbor commissioners when these lines were established, except at the time of the extension last year, and I am informed that Professors Mitchell and Whiting, of the Coast and Geodetic Survey, actually determined the lines.

There is a small gap in the line just above Tomlinsons Bridge on the west side of the harbor that the harbor commissioners have never filled because no one cared for it as yet. As they are anxious to have the established lines adopted as soon as practicable by the Government, and there is no immediate necessity for filling this gap, I forward the map and papers as requested.

These lines have been evidently established by the harbor commissioners and the State legislature with great care after a full hearing, and property has been bought and sold for years with reference to these lines, and riparian owners have considered that they had vested rights out to such harbor lines. For these reasons I do not think that any change should be made in the harbor lines established by the State of Connecticut, unless the interests of navigation are injuriously affected by the lines.

I have examined the plan of harbor lines carefully, and find that it is laid out with particular reference to the preservation of the harbor. It is in every essential feature the plan which I should have prepared and recommended had the matter been referred to me originally. I have had the description compared with the plan, and find it to be an accurate description of the harbor lines as shown on the tracing. I have had a few modifications made in the descriptions (in ink on the

* Omitted.

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printed copies), which make the descriptions more explicit, though they could not be misunderstood without these modifications if carefully compared with the map.

In my judgment the establishment of harbor lines in and for the harbor of New Haven, Conn., is essential to the preservation and protection of that harbor, as contemplated by section 12 of the river and harbor act of August 11, 1888, as amended and reenacted by section 12 of the river and harbor act of July 13, 1892.

For the reasons hereinbefore given, I consider the system of harbor lines as adopted by the New Haven board of harbor commissioners and by the general assembly of the State of Connecticut a suitable and proper system of harbor lines for that harbor; and therefore, if the Chief of Engineers concur, I recommend that the map and amended description of harbor lines herewith be forwarded to the Secretary of War, with the recommendation that they be established by him.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
November 13, 1894.

Respectfully submitted to the Secretary of War.

The board of harbor commissioners for New Haven Harbor, Connecticut, established by act of the State legislature of Connecticut of June 27, 1872, submits for approval of the Secretary of War, under the provisions of section 12 of act of September 19, 1890, certain harbor lines for New Haven Harbor adopted by said board and established by acts of the State legislature of Connecticut of various dates.

Lieut. Col. H. M. Robert, Corps of Engineers, the officer in charge of the improvement of New Haven Harbor, reports that he has examined the plan of harbor lines carefully and finds that "it is laid out with particular reference to the preservation of the harbor."

It is therefore recommended that the lines selected be approved, and that the Secretary place his approval upon the tracing submitted.

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

[Second indorsement.]

WAR DEPARTMENT, *November 17, 1894.*

Respectfully returned to the Chief of Engineers with the harbor lines approved as recommended.

JOSEPH B. DOE,
Acting Secretary of War.

DESCRIPTION OF HARBOR LINES AT NEW HAVEN, CONN.

[House bill No. 244.]

[61]

AN ACT to establish certain harbor lines in New Haven Harbor.

Be it enacted by the senate and house of representatives in general assembly convened:

SECTION 1. No wharf, pier, or other structure shall be extended into or over the water in that portion of New Haven Harbor hereinafter described and lying northerly of Tomlinsons Bridge, so called, beyond the lines hereinafter defined.

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QUINNIPIAC RIVER—EAST SIDE OF GRAND STREET BRIDGE.

The line starts from the east abutment of Grand Street Bridge, passes along the west face of Hemingway's Wharf, so called, to the southwest corner; thence runs to the southwest corner of Henry C. Rowe's Wharf; thence to a point in the water 390 feet from the northwest corner of the block of frame buildings to the southeast on the east shore, owned by Henry Lancraft, toward the center of A. Thomas's cupola, on Thomas's Wharf, so called, on the opposite shore; thence to the east corner of the south abutment of the projected new bridge across the Quinnipiac River; thence along the face of the abutment to the west corner of the abutment; thence to the north corner of the Marine Railway Wharf (Darton & Armstrong's), so called, a point also fixed by the distance of 181.6 feet from the center of the hoisting apparatus to the northeast corner of Poplar and River streets on the opposite side of the river; thence to about 40 feet outside of the northwest corner of the New Haven Chemical Works Wharf, so called, a point fixed by the distance of 365 feet from a point 6 feet on the line produced to the southwestward, from the southwest corner on the easterly and westerly face of a brick building (near the shore) of the New Haven Wire Works Company, toward the northwest corner of Blatchley avenue and River street, on the opposite side of the river; thence to a point in the water about 80 feet outside of the salient point of sedge at Stable Point, fixed by the intersection of these two lines, viz: The one from Grace church spire to the southwest corner of the brick and stone building owned by Alfred Hughes, the second house on the shore, south of the dike of Tomlinsons Bridge; the other from the center of M. L. Baldwin's cupola on the high crest east of the Quinnipiac to the intersection of the east boundary of the New Haven Steam Sawmill Company's property with the present south line of said property produced; thence to a point 300 feet back of the north corner of the east abutment of Tomlinsons Bridge.

QUINNIPIAC RIVER—WEST SIDE OF GRAND STREET BRIDGE.

The line starts from the east face of the west abutment of the Grand Street Bridge, where it is intersected by the south line of the bridge; thence passes nearly tangent to the outer corner of the New Wharf, so called, until it is intersected by the east line of Thomas's Wharf, so called, produced southwardly 29.2 feet; thence to the southwest corner of C. S. Maltby's Wharf, so called; thence to a point 700 feet from the northeast corner of Blatchley avenue and River street, on the line with the east side of Blatchley avenue, produced southwardly; thence toward the center of the tower of South church, so called, at the corner of Columbus and Liberty streets, New Haven, until intersected by a line hereinafter described, running toward the intersection of the east boundary of the New Haven Steam Sawmill Company's property with the present south line of said property produced.

MILL RIVER—SOUTH SIDE OF CHAPEL STREET BRIDGE, EAST SIDE OF DRAW.

The line starts 50 feet back along the face of the bridge, from the corner of the abutment, and runs 100 feet parallel with the face of the Hon. James E. English's Wharf, north of the bridge; thence back 50 feet, parallel with the face of the bridge; thence 550 feet on the line toward the southwest corner of Alfred Hughes's house, hereinbefore described; thence it is the production of the line from the point on the east boundary of the New Haven Steam Sawmill Company's property through and from the point at 550 feet, just mentioned, to where the line intersects that herein before mentioned as running to South church.

MILL RIVER—SOUTH SIDE OF THE CHAPEL STREET BRIDGE, WEST SIDE OF DRAW.

The line starts 50 feet back along the face of the bridge from the corner of the abutment, runs 100 feet perpendicular to the line formed by the corner of the abutment and the point 50 feet back; thence back 50 feet parallel with the face of the bridge; thence perpendicular to the last line, and produced until it intersects the south boundary of the New Haven Steam Sawmill Company's property produced.

NORTH SIDE OF CHAPEL STREET BRIDGE, EAST SIDE OF DRAW.

The line starts 25 feet back along the face of the bridge from the corner of the abutment, and runs along the face of Hon. James E. English's Wharf; thence to the south corner of the east abutment of the east channel under the Barnesville Bridge.

SOUTH SIDE OF THE BARNESVILLE BRIDGE.

The line starts from 200 feet along the south face of the bridge from the south corner of the east abutment of the east channel and runs toward the point 50 feet west of the north corner of the west abutment on the north side of Chapel Street

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Bridge 650 feet; thence perpendicular to this line until intersected by the line running parallel with the first line from the southwest corner of Lucien W. Sperry's Wharf, so called; thence to and along the west face of the wharf until it meets the bridge.

NORTH SIDE OF CHAPEL STREET BRIDGE, WEST SIDE OF DRAW.

The line starts 50 feet back from the north corner of the abutment and runs thence toward the point 200 feet along the face of the Barnesville Bridge until it intersects the northern face of the New Haven Gaslight Company's Wharf; thence to a point on the wharf face, near a brick shop of Mallory, Wheeler & Co.'s, called the Drumming shop, which point is fixed by range and distances as follows: By range from the northwest corner of projection on the building 44.7 feet, in line with the spire of Grace church; by distances from the northeast corner of the said projection 25.6 feet, and from the southern end of the truncated corner of said shop, 37.7 feet; thence to a point which is the intersection of the present north line of Mallory, Wheeler & Co.'s lock-shop property with the present wharf face; thence to the south corner of the west abutment on the south side of the Barnesville Bridge.

For a more particular description of the lines and points above described, reference is hereby made to the maps of the same on file in the office of the harbor commissioners of New Haven Harbor and in the office of the town clerk of New Haven.

SEC. 2. Nothing contained in this act shall be construed to give authority to any person to extend or construct a wharf, pier, or other structure in New Haven Harbor north of Tomlinsons Bridge.

SEC. 3. This act shall take effect from its passage, and shall not affect any suit now pending.

Approved July 2, 1875.

[House bill No. 276.]

CHAPTER XIV.

AN ACT to establish a harbor line in New Haven Harbor between Tomlinsons Bridge, so called, and Long Wharf, so called.

Be it enacted by the senate and house of representatives in general assembly convened:

SECTION 1. No wharf, pier, or other structure shall be extended into or over tidewater beyond the line hereinafter defined in that portion of New Haven Harbor hereinafter described lying between Tomlinsons Bridge, so called, and Long Wharf, so called. The line starts from a point which is the intersection of the southerly face of the wing wall of the westerly abutment of Tomlinsons Bridge with the easterly face of the steamboat company's wharf, and runs westerly to a point on the easterly side of Long Wharf, distant 1,490 feet from the intersection of said easterly side of Long Wharf with the southerly side of Basin Wharf, so called. Said harbor line is a curved line passing through the following-described points, viz: A point on the westerly side of the New York, New Haven and Hartford Railroad Company's coal wharf, distant 940 feet from the southerly line of East Water street, measured on the line of the westerly side of said coal wharf.

Also through a point on the center line of the East street outlet sewer, distant 1,100 feet from the southerly line of East Water street, measured on the center line of said sewer.

Also through a point distant 1,265 feet from the southerly line of East Water street, measured on a line at right angles to East Water street from the northwesterly corner of East Water and Wallace streets.

Also through a point distant 1,420 feet from the southerly line of East Water street, measured on a line at right angles to East Water street from the northeasterly corner of East Water and Hamilton streets.

Also through a point distant 1,695 feet from the southerly line of East Water street, measured on a line at right angles to East Water street from the northeasterly corner of East Water and Franklin streets.

Also through a point on the easterly side of the New Haven and Northampton Company's Wharf and distant 1,575 feet from the intersection of the easterly line of said wharf with the southerly face of Basin Wharf, so called.

Said harbor line is more fully shown as a broken black line on a map of the "Upper New Haven Harbor," dated 1872 and on file in the office of the board of harbor commissioners for New Haven Harbor, said map also forming part of this lay out.

SEC. 2. Nothing contained in this act shall be construed to give authority to any person to extend or construct a wharf, pier, or other structure in New Haven Harbor between said Tomlinsons Bridge and said Long Wharf.

SEC. 3. This act shall take effect from its passage and shall not affect any suit now pending.

Approved, March 4, 1878.

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[House bill No. 171.]

[111.]

AN ACT to establish certain harbor lines in New Haven Harbor.

Be it enacted by the senate and house of representatives in general assembly convened:

SECTION 1. No wharf, pier, or other structure shall be extended into or over tide water beyond the lines hereinafter defined in that portion of New Haven Harbor hereinafter described lying westerly of Long Wharf, so called, and in that portion of New Haven Harbor hereinafter described lying between Grand Street Bridge and Lewis Bridge, so called.

WESTERLY SIDE OF LONG WHARF.

The line starts from the present bulkhead, on the southerly side of the tracks of the New York, New Haven and Hartford Railroad Company, and runs a straight line nearly parallel with Long Wharf, on the westerly side thereof, to opposite the end of said wharf, and passes through the following-described points, viz: A point on the westerly side of said Long Wharf 250 feet distant from the face of the sandstone water table at the northeasterly corner of the brick building, the office of H. Trowbridge's Sons, No. 79 Long Wharf, measured on a line with the northerly side of said building. Also through a point on the westerly side of said Long Wharf 250 feet distant from the southeasterly corner of the brick building of Sperry & Barnes. Said harbor line is fully shown as a red line on a map dated June 25, 1880, on file in the office of the board of harbor commissioners for New Haven Harbor, said map also forming a part of this lay out.

WESTERLY SIDE OF QUINNIPIAC RIVER—GRAND STREET BRIDGE TO LEWIS BRIDGE.

The line starts from the northeasterly corner of the westerly abutment of the Grand Street Bridge, or Dragon Bridge, so called, and runs along the face of the present bulkhead wall of the Smith Tuttle property to the southeasterly corner of the wharf now or formerly of the estate of Lucius Elliot; thence in a straight line to the southeasterly corner of H. M. Rowe's Wharf; thence in a straight line passing through the northeasterly corner of William J. Benedict's Wharf to the tangent point of a curve of 500 feet radius drawn tangent to the last-described line and a line passing through the southeasterly corner of Daniel H. Brown's Wharf and through the southeasterly corner of John Munson's Wharf; thence along the said curve of 500 feet radius to the tangent point of the said curve and the line passing through the said corner of the said Brown's and Munson's wharves; thence in a straight line passing through the southeasterly corner of John Munson's Wharf to the southeasterly corner of Daniel H. Brown's Wharf; thence in a straight line to the northeasterly corner of Mrs. Eliza Goodsell's Wharf; thence in a straight line passing through the southeasterly corner of S. Chipman & Co.'s Wharf to the intersection of this last-described line and a line parallel with and 115 feet distant from the westerly line of that part of North Front street between Lombard and English streets; thence in the said parallel line distant 115 feet from the westerly line of North Front street to a point 40 feet northerly from the intersection of the said parallel line and the easterly line extended of that part of North Front street between Middletown avenue and Dover street; thence by a curve of 500 feet radius drawn tangent to the said parallel line at the last-described point to the tangent point of the said curve and a line drawn from the southeasterly corner of the city abutment of Lewis Bridge; thence in a straight line to the said southeasterly corner of the city abutment of Lewis Bridge. Said harbor line is fully shown as a red line on a map dated August 25, 1880, on file in the office of the harbor commissioners for New Haven Harbor, said map also forming a part of this lay out.

SEC. 2. Nothing contained in this act shall be construed to give authority to any person to extend or construct a wharf, pier, or other structure in New Haven Harbor westerly of Long Wharf, or between the Grand Street Bridge and Lewis Bridge.

SEC. 3. This act shall take effect from its passage.

Approved, March 29, 1881.

[Senate bill No. 202.]

[404.]

AN ACT concerning harbor lines in New Haven Harbor.

Be it enacted by the senate and house of representatives in general assembly convened:

SECTION. 1. No wharf, pier, or other structure shall be extended into or over tide water in those portions of New Haven Harbor hereafter described beyond the lines hereinafter defined.

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MILL RIVER, FROM GRAND AVENUE TO NEW YORK, NEW HAVEN AND HARTFORD RAILROAD BRIDGE.

The line of the westerly side of the westerly channel commences at a point which is the intersection of the northerly line of Grand avenue with the westerly abutment of the bridge; thence running northerly along the face of the present wharf to a point 255 feet from Grand avenue; thence in a straight line to a point which is the southeasterly corner of the southerly wing wall of the westerly abutment of the stone bridge of the New York, New Haven and Hartford Railroad Company over Mill River.

The easterly line of the westerly channel is parallel with and 85 feet perpendicularly distant from the above-described westerly line from said railroad bridge southerly to the southerly line of Myrtle street extended; then commencing at a point in the northerly line of Grand avenue 66 feet easterly from the above-described point at the intersection of the northerly line of Grand avenue with the westerly face of the bridge abutment; thence running northerly along the face of the present wharf of Austin Mansfield to a point 500 feet from Grand avenue. The line on the westerly side of the easterly channel commences at a point in the northerly line of Grand avenue 50 feet back from the face of the westerly abutment of the bridge over the easterly channel; thence running in a straight line perpendicular to Grand avenue 75 feet; thence in a straight line to a point 390 feet from the northerly line of Grand avenue. Said point is in a line perpendicular to Grand avenue from a point in said avenue 235 feet from the face of the westerly abutment of said bridge over the easterly channel; thence in a straight line to the point in the easterly line of the westerly channel 500 feet from Grand avenue.

The line on the easterly side of the easterly channel commences at a point in the northerly line of Grand avenue 30 feet back from the face of the easterly abutment of the bridge over the easterly channel; thence running in a straight line to the southwesterly corner of the present wharf of the Old Colony Distillery Company; thence along the face of said wharf to its northwesterly corner; thence in a straight line parallel with Haven street to the northerly line of Clay street; thence in a straight line to the intersection of the southerly line of Myrtle street extended with the above-described easterly line of the westerly channel.

WEST SHORE, FROM LONG WHARF TO KIMBERLY AVENUE.

The line commences at a point which is at the intersection of the southerly line of Brewery street extended with the harbor line already established parallel with and 250 feet from Long Wharf; thence running southwesterly in a straight line, which is the southerly line of Brewery street extended to its intersection with a line parallel with and 950 feet perpendicularly distant from the easterly line of Hallock avenue; thence on said straight line parallel with and 950 feet perpendicularly distant from Hallock avenue to its intersection with a line parallel with and 427 feet perpendicularly distant from the southerly line of South Water street; thence on said straight line parallel with and 427 feet perpendicularly distant from South Water street to its intersection with the westerly line of Howard avenue extended; thence in a straight line perpendicularly to Howard avenue to its intersection with the line from Kimberly avenue southerly, which line commences at a point in the southerly line of Kimberly avenue 50 feet back from the face of the easterly abutment of the bridge over the easterly channel of West River, and thence runs southerly, making an angle of 68 degrees with the westerly extension of the southerly line of Kimberly avenue; thence along such last-named line to Kimberly avenue.

EAST SHORE, FROM TOMLINSONS BRIDGE TO FORT HALE.

The line commences at a point on the easterly approach of Tomlinsons Bridge 260 feet back from the face of the easterly abutment of said bridge and 16 feet perpendicularly distant from the face of the southerly coping; thence running in a straight line which bears 6° and 28′ westerly from Southwest Ledge Light until it intersects a straight line drawn from Townsend's cupola to the cross on the main tower of South church; thence in a straight line toward the Old Light to its intersection with the center line extended of the cut stone raceway from Fort Hale moat.

SEC. 2. Nothing contained in this act shall be construed to give authority to any person to extend or construct a wharf, pier, or other structure in those portions of New Haven Harbor above described.

SEC. 3. This act shall take effect upon its passage, and shall not affect any suit now pending.

Approved May 18, 1893.

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MODIFICATION OF HARBOR LINES IN NEW HAVEN HARBOR, CONNECTICUT.

[Tyler, Ingersoll & Moran, counselors at law.]

NEW HAVEN, CONN., *February 20, 1895.*

DEAR SIR: On behalf of the New Haven Electric Company, we respectfully ask that a slight change be made in the present harbor line on the westerly side of the easterly channel of Mill River. It is the intention of the New Haven Electric Company to build a retaining wall along the line of its property, and before doing so desires to have the harbor line adjoining its property straightened so as to run at right angles to Grand avenue, the street upon which its property is located. The small space included in the proposed change is substantially all mud flat.

The matter was brought before the board of harbor commissioners of this city, and said board, after considering the matter, approved of the proposed change, but decided that it had no authority in the premises and referred the company to your Department. The map* inclosed was prepared by the secretary and engineer of the board of harbor commissioners, Mr. A. B. Hill. The matter was presented to Colonel Robert, of the United States Corps of Engineers, when last here on official business, and he directed that the papers be sent direct to the War Department. We attach herewith a definite and specific description of the proposed new line in accordance with the map also hereto attached.

Very truly, yours,

TYLER, INGERSOLL & MORAN.

Hon. DANIEL S. LAMONT,
Secretary of War.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
February 23, 1895.

Respectfully referred to Col. H. M. Robert, Corps of Engineers, for report.

By command of Brigadier-General Casey:

H. M. ADAMS,
Major, Corps of Engineers.

[Third indorsement.]

ENGINEER OFFICE, U. S. ARMY,
New York, February 27, 1895.

Respectfully returned to the Chief of Engineers.

While at New Haven on other business this matter was brought to my attention, and I personally examined the site and ascertained the views of the harbor commissioners upon this request. I am informed by one of the commissioners that their approval, which is required by the laws of the State of Connecticut before the work can be done, has been given.

*Not printed.

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I can see no objection to granting the request, though in place of the description of the line presented therewith I would suggest the following modification of the harbor line:

Strike out third paragraph, page 3, of description of these lines and insert the following:

"*South side of the Barnesville Bridge.*—The line starts from 158.5 feet along the south face of the bridge, from the south corner of the east abutment of the east channel, and runs thence southward perpendicularly to Grand avenue, a distance of 150 feet; thence toward the point 50 feet west of the north corner of the west abutment on the north side of Chapel Street Bridge, 494 feet; thence perpendicular to this line, until intersected by the line running parallel with the first line from the southwest corner of Lucien W. Sperry's Wharf, so called; thence to and along the west face of the wharf, until it meets the bridge."

If the request of the petitioners be granted the amount of tidewater displaced by filling out to the new line would be about 500 cubic yards. Under section 9 of the river and harbor act of August 17, 1894, I should regard it as necessary, as a matter of precedent, to require the parties to dredge and remove from between high and low water marks in that vicinity an amount not less than 500 cubic yards, prism measurement, the location and conduct of such dredging to be subject to the approval of the engineer officer in charge of the improvement of New Haven Harbor, Connecticut, and the cost of the work and of any necessary inspection to be paid by the petitioners. The harbor commissioners are desirous that this provision for dredging be enforced in all cases in New Haven Harbor.

HENRY M. ROBERT,
Colonel, Corps of Engineers.

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
February 28, 1895.

Respectfully returned to the Secretary of War.

Application is made for a modification of the harbor line approved by the Secretary of War November 17, 1894, on the westerly side of the easterly channel of Mill River, New Haven Harbor, Connecticut.

Inviting attention to the report of Colonel Robert, in third indorsement hereon, it is recommended that the line be modified on the conditions stated by him.

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

[Fifth indorsement.]

WAR DEPARTMENT, *March 2, 1895.*

Approved as recommended by the Chief of Engineers.

DANIEL S. LAMONT,
Secretary of War.

LETTER OF COL. HENRY M. ROBERT, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York City, May 16, 1895.

GENERAL: I have the honor to inclose herewith a letter, with inclosure (by Mr. A. B. Hill, late city engineer of New Haven, Conn.), received from Messrs. Tyler, Ingersoll & Moran relating to the modification in

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New Haven Harbor lines, which were approved by the Secretary of War March 2, 1895.

The description suggested by Mr. Hill is more definite and correct according to existing conditions than the one submitted and approved, and I therefore recommend that it be adopted as a substitute therefor. In preparing the description submitted with my indorsement, dated February 27, 1895, it was overlooked in this office that by the change the short line perpendicular to Grand avenue becomes the first line of the description, and the change of reference to the southeast corner of the west abutment corresponds better with the bridge as it now exists, though I consider that "*as in 1895*" should be inserted to distinguish it from the other references to the same bridge made in the original description of harbor lines.

The description as thus amended would read:

"*South side of the Barnesville Bridge.*—The line starts from a point in the southerly line of Grand avenue 107.5 feet westerly of the southeast corner of the parapet of the west abutment of the easterly span of Barnesville Bridge (as in 1895), and runs thence southward, perpendicular to Grand avenue, a distance of 150 feet; thence toward a point on the northerly side of Chapel Street Bridge causeway 50 feet west of the northeast corner of the west abutment of said bridge, a distance of 494 feet; thence perpendicularly to this line until intersected by a line running parallel to the last above-described line from the southwest corner of Lucien W. Sperry's Wharf, so called; thence to and along the west face of the wharf to the southerly line of Grand avenue."

I have submitted a draft of this amended description to the board of harbor commissioners of New Haven, and it meets their approval, for reasons as stated herein.

I therefore respectfully recommend that this description be substituted for the one approved by the Secretary of War March 2, 1895, as being intended to cover the same lines and as being more explicitly correct.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Colonel, Corps of Engineers.

Brig. Gen. WM. P. CRAIGHILL,
Chief of Engineers, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
May 17, 1895.

Respectfully submitted to the Secretary of War.

On November 17, 1894, the Secretary of War established harbor lines for New Haven Harbor, Connecticut, and on March 2, 1895, approved a modification of that portion of the established lines on the westerly side of the easterly channel of Mill River.

Colonel Robert, the district officer, now submits an amended description of the aforesaid modified lines and recommends that it be substituted for the one approved March 2, 1895, as being intended to cover the same lines and as being more explicitly correct.

Approval of the amended description is recommended.

H. M. ADAMS,
Acting Chief of Engineers.

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[Second indorsement.]

WAR DEPARTMENT, *May 20, 1895.*

Approved as recommended by Colonel Robert and the Acting Chief of Engineers.

By order of the Secretary of War:

JOHN TWEEDALE, *Chief Clerk.*

LETTER OF MESSRS. TYLER, INGERSOLL & MORAN, COUNSELORS AT LAW.

NEW HAVEN, CONN., *March 11, 1895.*

DEAR COLONEL: In the matter of the change of harbor lines attaching the property of the New Haven Electric Company at Grand avenue, on Mill River, we would respectfully say that the action of your Department in authorizing the change of line with the condition that "the New Haven Electric Company dredge and remove from between high and low water marks in that vicinity an amount of dredging not less than 500 cubic yards, prism measurement, the location and conduct of such dredging to be subject to the approval of the engineer officer in charge of the improvement of New Haven Harbor, Connecticut, and the cost of the work and of any necessary inspection to be paid by the petitioners," is entirely satisfactory to our clients, the New Haven Electric Company, and we would ask that you give us the name of the officer in charge of the dredging whom we shall consult in carrying out the dredging contemplated.

We submitted your communication containing modifications of the line proposed by us to Mr. A. B. Hill, clerk and engineer of the New Haven Harbor commissioners, who drafted the map for use and gave us the description of the line, and we herewith inclose for your information his letter with reference to the same. It may be that you will want to change the description of the line so as to make it conform with the present conditions in that vicinity. We attach to his letter Mr. Hill's sketch* explaining the letter.

Awaiting your advices in the matter, believe us, very truly, yours,

JAMES T. MORAN,
TYLER, INGERSOLL & MORAN.

Col. HENRY M. ROBERT.

LETTER OF MR. A. B. HILL.

NEW HAVEN, CONN., *March 9, 1895.*

DEAR SIR: We have examined the layout of proposed "harbor line on south side of Barnesville Bridge," and find the description substantially correct so far as change for which you petitioned is concerned, provided the term "east abutment" refers to the east abutment of the old bridge, which was the point referred to in the original layout. Since that time, however, a new bridge has been built with the abutments in front of the old abutments, so that if the layout is interpreted as meaning the new abutment, which would naturally be the case, the modification being dated in 1895, the harbor line will be about 8 feet westerly of the location intended.

We think Colonel Robert overlooked the fact that in changing the description of the first line of the layout he has also changed the layout of the fourth course, which is made parallel with the first course. It should have been made parallel with the second course. If the description stands the harbor line on the easterly side of the west channel will cut diagonally more than halfway across the channel, as shown by red lines on accompanying sketch.

We would suggest the following description as obviating the difficulties mentioned:

"The line starts from a point in the southerly line of Grand avenue 107.5 feet westerly of the southeast corner of the parapet of the west abutment of the easterly span of Barnesville Bridge (as in 1895) and runs thence southward, perpendicularly to Grand avenue, a distance of 150 feet; thence toward a point on the northerly side of Chapel Street Bridge causeway 50 feet west of the northeast corner of the west abutment of said bridge, a distance of 494 feet; thence perpendicularly to this line

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*Not printed.

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until intersected by a line running parallel to the last above described line, from the southwest corner of Lucien W. Sperry's Wharf, so called; thence to and along the west face of the wharf to the southerly line of Grand avenue."

Yours, very truly,

A. B. HILL.

JAMES T. MORAN, Esq.

D 40.

ESTABLISHMENT OF HARBOR LINES IN MILFORD HARBOR, CONNECTICUT.

BRIDGEPORT, CONN., *February 21, 1894.*

DEAR SIR: It is our belief that the establishment of harbor lines in Milford Harbor, Connecticut, is essential to the preservation and protection of the said harbor, and we would respectfully ask that you investigate same, and if you so find it, that you have suitable harbor lines established, under act of Congress of July 13, 1892, conferring such authority.

Marshall E. Morris and myself each desire to build docks there the coming season, and wish to commence soon as season will allow. In order to do so, it is desirable, both for protection of the harbor against infringement, and that our docks and those of others who may contemplate building may be properly placed, that the lines be established by competent and unquestioned authority. We shall be pleased to point out where we intend building if notified by engineer in charge.

Yours, very truly,

H. J. LEWIS.

Hon. DANIEL S. LAMONT,
Secretary of War.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
February 24, 1894.

Respectfully referred to Lieut. Col. H. M. Robert, Corps of Engineers, for report.

If, in his opinion, harbor lines should be established at Milford, under section 12 of the river and harbor act of August 11, 1888, as amended and reenacted by the river and harbor act of September 19, 1890, Lieutenant-Colonel Robert is requested to submit a map and description showing the location of the lines recommended for approval.

By command of Brig. Gen. Casey:

H. M. ADAMS,
Major, Corps of Engineers.

[Third indorsement.]

ENGINEER OFFICE, U. S. ARMY,
New York, September 1, 1894.

Respectfully returned to the Chief of Engineers, with report of this date.

HENRY M. ROBERT,
Lieut. Col., Corps of Engineers.

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REPORT OF LIEUT. COL. HENRY M. ROBERT, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., September 1, 1894.

GENERAL: I have the honor to submit the following report upon the subject of harbor lines for Milford Harbor, Connecticut, referred to me by your indorsement of February 24, 1894, upon letter of Mr. H. J. Lewis, of Bridgeport, Conn., to the Secretary of War, dated February 21, 1894.

March 1, 1894, I reported that, in my opinion, harbor lines should be established at Milford, under section 12 of the river and harbor act of August 11, 1888, as amended and reenacted by the river and harbor act of September 19, 1890, and requested an allotment of $200 for the necessary expenses of the work, which was made by letter of the Chief of Engineers of March 2, 1894, from the appropriation for "examinations, surveys, and contingencies of rivers and harbors."

In April and May, 1894, a detailed survey of the shores of the upper part of Milford Harbor was made and platted, and a plan for harbor lines was prepared. To enable interested parties to express their views upon such harbor lines, several blue prints of them were sent to Milford on June 7 for public inspection, and on June 26 a public hearing was held in the office of the town clerk of Milford. This hearing was attended by nine persons, representing the principal interests along the water front, and the plans for harbor lines were fully discussed.

At the request of certain of the parties, and with the approval of the others, slight changes in the plan were made which it was thought would improve the public harbor and better accommodate individual interests.

The proposed harbor lines cross "Town Dock" on the west side of the harbor, and on the east side, opposite and above Town Dock, they cross certain marsh lands, the property of Mr. Thomas C. Fowler, at about high-water level. Mr. Fowler has executed a paper* (submitted herewith) conveying to the United States the right to establish harbor lines upon his property as proposed, and to excavate up to such harbor lines. Town Dock is the property of the town of Milford. Capt. E. L. Ford, one of the town selectmen, informed me that the town would undoubtedly authorize the removal of the dock outside the harbor line whenever the United States is ready to dredge there. Formal authority for this can not be obtained until the next town meeting, which is to be held in October. But should the town refuse to authorize the removal of the outer part of the dock, I should still recommend that the line be drawn across it as proposed to prevent further encroachment upon the natural harbor.

A plan* and description of proposed harbor lines for Milford Harbor is submitted herewith. In my judgment these proposed harbor lines meet the present needs of the public harbor, and its prospective needs as far as they can be anticipated; they are also satisfactory to interested owners of shore property, and therefore I respectfully recommend them for approval.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

* Not printed.

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[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
September 5, 1894.

Respectfully submitted to the Secretary of War.

The establishment of harbor lines for the harbor of Milford, Conn., having been requested, the subject has been given careful consideration by Lieut. Col. Henry M. Robert, Corps of Engineers, who submits the accompanying report recommending the establishment of the lines shown in red on a drawing, and described in a separate paper marked A, both herewith.

I concur in the views of Colonel Robert, and recommend that the lines selected be approved and that the Secretary place his approval both upon the tracing and upon this report.

H. M. ADAMS,
Acting Chief of Engineers.

[Second indorsement.]

WAR DEPARTMENT, *September 6, 1894.*

Approved as recommended by the Acting Chief of Engineers.

J. M. SCHOFIELD,
Major-General, Acting Secretary of War.

A.—DESCRIPTION OF PLAN OF HARBOR LINES FOR THE HARBOR OF MILFORD, CONN., RECOMMENDED FOR ADOPTION BY LIEUT. COL. HENRY M. ROBERT, CORPS OF ENGINEERS, U. S. ARMY, SEPTEMBER 1, 1894.

The proposed pier and bulkhead lines to be identical, and to be as follows:

East side of the harbor.—Starting at a point N. 61° 10′ E. and 30 feet distant from the northeast corner of the coal shed of the Milford Straw Works, which point is also in line between the said corner of the coal shed and the south gable of Sarah Greene's house (built 1894), and is also S. 55° 00′ E., and 63 feet distant from the east corner of the main brick building of the said Straw Works; thence,

1. By a course N. 61° 10′ E., being directly toward the south gable of Sarah Greene's house, above mentioned, for a distance of 400 feet, to a point in the harbor nearly in line with the tail-water from Fowler's "Old Mill;" thence,

2. By a course S. 28° 50′ E. and at right angles to the last-named course, being due away from the middle (approximately) of the southeast side of the "Old Mill" for a distance of 230 feet to a point in the harbor, bare at low tide; thence,

3. By a course S. 15° 30′ W. (and due away from a point in line with the southwest face of Benjamin Sanford's house and 66 feet southeast from the south corner of said house) for a distance of 1,472 feet, crossing part of the marsh lands of Thomas Fowler to a point in the harbor lying between the mouth of the creek which bounds said Fowler's lands on the south and the south corner of house of C. A. L. Totten, on the west side of the harbor; thence,

4. By a course S. 1° 09′ W. (and due away from a point 12 feet east of the southeast corner of an old barn on the rocky island at the head of the harbor, property of Alberria L. Fowler) for a distance of 970 feet to a point in the harbor nearly in line with the outlet ditch of John S. Walker's duck pond and 60 feet out from the edge of the marsh (being also as nearly as may be in line of the southwest side of Pond street extended across the harbor); thence,

5. By a course S. 21° 56′ E., running due toward a brownstone monument on Burns Point, for a distance of 619 feet to a point in the harbor, which point is in line with the outer or southwest faces of William M. Merwin & Sons' two uppermost wharves (and is also practically in line of a ditch or drain about 400 feet north of said Merwin's upper wharf); thence,

6. By a course S. 38° 22′ E., passing along the outer or southwest faces of said Merwin's two uppermost wharves, a distance of 628 feet, to a point exactly at the south corner of Merwin's middle (and original) wharf; thence,

7. By a course S. 58° 50′ E., a distance of 153 feet, to a point exactly at the south middle corner of Merwin's new wharf; thence,

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8. By a course S. 75° 40′ E., and directly toward the north corner of the house of Charles H. Wilcox, a distance of 835 feet, more or less, to a point at high-water mark on the east shore of the harbor about 400 feet above the bridge across the Indian River outlet.

The further extension of harbor lines on the east side of Milford Harbor to be determined under provisions of law, when such extension shall become expedient and necessary.

West side of the harbor.—Starting at a point in the harbor N. 61° 10′ E., and 30 feet distant from the northeast corner of the coal shed of the Milford Straw Works, being the same point as the starting point for harbor lines for the east side of the harbor; thence,

1. By a course S. 24° 13′ E. for a distance of 410 feet, to a point in the harbor near the edge of the marsh at the bend in shore line of the property of the Milford Straw Works; thence,

2. By a course S. 19° 56′ W., passing along the east face of the coal run of Birge & Hull, as it was in April, 1894, crossing Town Dock at a point on its north face, 84 feet back from its outer end, to a point in the harbor (the course being due away from a point 27 feet southeasterly from the south corner of Samuel C. Peck's house and in line with the southwest front of that house), a total distance of 1,815 feet; thence,

3. By a course S. 23° 28′ E., being due away from a point on the southwest side of Pond street, which point is in line with the northwest corner of C. A. L. Totten's house, being also a course toward the westerly pile of a cluster of four piles driven by Marshall Morris at or near the edge of the marsh grass, to a point 75 feet northwesterly from said westerly pile, a total distance of 1,488 feet; thence,

4. By a course S. 59° 14′ E, being directly toward a point in the center line of Long Jetty at its extreme shore end, a distance of 650 feet, more or less, to a point where this line meets mean high-water mark on the north shore of Burns Point.

The further extension of harbor lines on the west side of Milford Harbor to be determined under provisions of law, when such extension shall become expedient and necessary.

The bearings of courses in the foregoing description are magnetic, and are referred by transit angles to a magnetic meridian observed at shore end of Long Jetty, in April, 1894, according to which meridian the course from the brownstone monument on the north side of Burns Point to the east corner of C. A. L. Totten's house is N. 26° 50′ W., and the course from the south corner of William M. Merwin & Sons' original (or middle) wharf to the southeast corner of the north abutment of the bridge across the mouth of Indian River is S. 53° 24′ E.

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APPENDIX E.

IMPROVEMENT OF HUDSON RIVER AND NEW YORK HARBOR AND OF RIVERS AND HARBORS IN THEIR VICINITY, NEW YORK AND NEW JERSEY; OF RIVERS AND HARBORS IN SOUTHWESTERN PART OF LONG ISLAND AND NEAR STATEN ISLAND, NEW YORK, AND IN NORTHEASTERN NEW JERSEY.

REPORT OF LIEUT. COL. G. L. GILLESPIE, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1896, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Hudson River, New York.
2. Harbor at Saugerties, N. Y.
3. Harbor at Rondout, N. Y.
4. Wappinger Creek, New York.
5. Harlem River, New York.
6. East River and Hell Gate, New York.
7. Newtown Creek, New York.
8. Buttermilk Channel, New York Harbor.
9. Gowanus Bay, New York.
10. New York Harbor, New York.
11. Jamaica Bay, New York.
12. Raritan Bay, New Jersey.
13. Sumpawanus Inlet, New York.
14. Canarsie Bay, New York.
15. Sheepshead Bay, New York.
16. Arthur Kill, New York and New Jersey.
17. Channel between Staten Island and New Jersey.
18. Passaic River, New Jersey.
19. Elizabeth River, New Jersey.
20. Rahway River, New Jersey.
21. Raritan River, New Jersey.
22. South River, New Jersey.
23. Keyport Harbor, New Jersey.
24. Mattawan Creek, New Jersey.
25. Shoal Harbor and Compton Creek, New Jersey.
26. Shrewsbury River, New Jersey.
27. Manasquan (Squan) River, New Jersey.
28. Removing sunken vessels or craft obstructing or endangering navigation.

EXAMINATIONS AND SURVEY.

29. Peekskill Harbor, New York.
30. Carrls River, New York.
31. Gravesend Bay, New York.
32. West Branch of Newtown Creek, New York.
33. Rahway River, New Jersey.
34. Elizabeth River, New Jersey.
35. Inlet at mouth of Shark River, New Jersey.
36. Raritan Bay, New Jersey, between South Amboy and Great Beds Light.

HARBOR LINES.

37. East River, New York, in the vicinity of Rikers Island.

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ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., July 1, 1895.

GENERAL: I have the honor to transmit herewith annual reports * * * for the fiscal year ending June 30, 1895, upon the works of river and harbor improvement under my charge.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
Lieut. Col., Corps of Engineers.

Brig. Gen. WM. P. CRAIGHILL,
Chief of Engineers, U. S. A.

E 1.

IMPROVEMENT OF HUDSON RIVER, NEW YORK.

The Annual Report of the Chief of Engineers for 1885, Part I, page 677, contains a history of this improvement, accompanied by original reports and two sketches showing its condition at that time.

The only part of the Hudson River which has been improved by the General Government is a stretch about 20 miles long, beginning at the head of navigation at Troy, N. Y., about 6 miles above Albany, and extending down the river to New Baltimore, about 14 miles below Albany.

While there has always been enough water below New Baltimore for navigation, this upper section of the river, so far as its history is known to us, has always been obstructed by bars and shoals, due to the existence of numerous islands and sloughs, and the consequent diversion of the river's waters through too many channels.

Prior to 1831, when the jurisdiction of the General Government over these waters was confirmed by judicial decision, the State of New York had made efforts to improve the navigation of the upper part of the river, but the method followed, consisting chiefly of dredging and of the construction of a few spur dikes, had produced very little permanent effect.

In 1831 the General Government, rejecting the spur construction, began the present general system of improvement, consisting of channel contraction by the use of longitudinal dikes, assisted, when necessary, by dredging.

This new system was adopted the same year by the State authorities, and from that date to 1890 the improvement was conducted jointly by the State and the General Government, though without any positive mutual agreement.

Under this system the United States constructed two dikes in 1835, 1836, 1837, and 1838.

Then followed a long interval of time in which nothing was done by the United States except in 1852, but in 1863 the State of New York took up the improvement on the general plan adopted by the United States in 1831, viz, substituting a system of longitudinal dikes instead of the jetty system, and between 1863 and 1867 built six important longitudinal dikes of this kind. (Annual Report of 1885, p. 678.)

The work was again taken up by the United States in 1864, when, out of the general sum appropriated for river and harbor improvements, $33,000 was allotted for the Hudson River improvement, and this was followed by the act of June 13, 1866, which appropriated $50,000 for the same work.

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The plan of improvement adopted in 1867 provided for securing a navigable channel 11 feet deep at mean low water from New Baltimore up to Albany and 9 feet deep at mean low water from Albany up to Troy.

The following is a description of the plan:

First. A system of longitudinal dikes, to confine the current sufficiently to allow the ebb and flow of the tidal current to keep the channel clear. These dikes to be gradually brought nearer together from New Baltimore toward Troy, so as to assist the entrance of the flood current and increase its height, their height to be kept approximately at the level of the tidal high water, so as not to confine the freshets, the exact level, however, being left to be determined by experience as the work progresses.

Second. That the dredge be used, so far as necessary, to open the channels above described, which the current should not be allowed to do, except very gradually, lest accumulations dangerous to navigation be formed below.

Third. Keeping, as far as practicable, the side reservoirs open to the passage of tidal currents by gaps at their lower extremities in order to increase the tidal flow.

Fourth. Dumping all dredged material in secure places, where it can not be moved back again into the channel by the current.

Fifth. Constructing the dikes of timber and stone in a manner to secure their permanency at a minimum cost, the details, varying with the locality, to be left to the discretion of the local engineer, to be so designed as to admit of having an increased height given to the dikes if necessary.

Sixth. To protect, when necessary, the banks and islands against the abrading action of the currents by revetments.

Seventh. That limits, beyond which no encroachments upon the channel should be made, be prescribed, and that any such encroachments be reported to the engineer in charge.

The cost of the improvement, according to the estimate of 1867, was $1,000,000, but the amount which had been actually spent upon the project up to June 30, 1892, the date of its practical completion, was $1,247,940.29

From the nature of the materials which enter into the construction of the dikes and from the limited sums which are applied annually to renew the parts which become unserviceable, whether by natural decay or otherwise, it can be well understood that the estimates prepared from time to time for the completion of the project must be accepted as approximately accurate for only a short period of time. This statement is necessary for a correct understanding of the apparent discrepancy between the estimated and the actual cost of the project.

A new project was adopted in 1891, which provided for maintaining old improvements and constructing new regulating works along 8 additional miles of the river below New Baltimore, and also deepening the entire reach of the river under improvement, so as to afford a channel 400 feet wide and 12 feet deep at mean low water, from Coxsackie to the foot of Broadway, Troy, N. Y., and thence 300 feet wide and 12 feet deep to the State Dam.

The estimated cost of the project is $2,500,000, provided the entire work be completed within five years.

The sanction of Congress to the project was given by the river and harbor act approved July 13, 1892, with the proviso that contracts

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might be entered into by the Secretary of War for such materials and work as might be necessary to carry out the plan, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate the sum of $2,447,906.

The State of New York has been accustomed to make an appropriation at every session of its legislature for the improvement of the Hudson River, and prior to 1867 the money was applied to the construction of dikes on the left bank of the river from Houghtailing Island to Albany, to jetties, dams, and to temporary measures of relief, and also to dredging at the points where shoals were discovered after spring freshets. The present disposition of the State authorities is to leave the improvement solely to the General Government.

Sections 6 and 7 of the river and harbor act of September 19, 1890, make it unlawful to dump into the navigable waters of the United States any materials which shall tend to impede or obstruct navigation, or to excavate, or fill, or in any manner to alter or modify the course, location, condition, or capacity of the channel of said navigable waters, unless approved and authorized by the Secretary of War. These are wise provisions for the protection of the navigable waters of the United States, and it is hoped that a considerate enforcement of the law will serve hereafter to protect the channel of the river by maintaining its regimen, and at the same time to allow material to be taken freely from the river for private and public uses.

Section 3 of the river and harbor act of July 13, 1892, amendatory of section 7 of the act of 1890, referring to structures which may be authorized in navigable waters, is so important that a copy is here inserted for the information of the public:

That it shall not be lawful to build any wharf, pier, dolphin, boom, dam, weir, breakwater, bulkhead, jetty, or structure of any kind outside of the established harbor lines, or in any navigable waters of the United States where no harbor lines are or may be established, without the permission of the Secretary of War, in any port, roadstead, haven, harbor, navigable river, or other waters of the United States, in such manner as shall obstruct or impair navigation, commerce, or anchorage of said waters; and it shall not be lawful hereafter to commence the construction of any bridge, bridge draw, bridge piers and abutments, causeways, or other works over or in any port, road, roadstead, haven, harbor, navigable river, or navigable waters of the United States, under any act of the legislative assembly of any State, until the location and plans of such bridge or other works have been submitted to and approved by the Secretary of War, or to excavate or fill, or in any manner to alter or modify the course, location, condition, or capacity of any port, roadstead, haven, harbor, harbor of refuge, or inclosure within the limits of any breakwater, or of the channel of any navigable water of the United States unless approved and authorized by the Secretary of War: *Provided*, That this section shall not apply to any bridge, bridge draw, bridge piers and abutments the construction of which has been heretofore duly authorized by law, or be so construed as to authorize the construction of any bridge, drawbridge, bridge piers and abutments, or other works under an act of the legislature of any State, over or in any stream, port, roadstead, haven, or harbor, or other navigable water not wholly within the limits of such State.

The average rainfall covering the past sixty-seven years, from observations recorded in the office of the U. S. Weather Bureau at Albany, N. Y., is 39.69 inches. The greatest raintall in any year was recorded in 1871, when 56.78 inches fell; the least rainfall in any year occurred in 1839, when 18.32 inches fell. The greatest known rainfall in any one month occurred in October, 1869, when 13.8 inches fell; the least known rainfall in any one month was in January, 1860, when only 0.08 of an inch fell.

At times, during the dry season of almost every year, for a month at least, no water flows over the State Dam at Troy, and excepting what

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comes in through the lockage of the canals there is, during that period, little apparent fresh-water supply to the flow of the river. From this fact it is evident that the navigation of the Hudson River at the low stage is dependent in a large degree upon the tidal prism of the river.

The mean rise and fall of tides as determined by observations made by U. S. Engineers in 1876—

	Feet.
At State Dam, Troy, N. Y., is	0.80
At Nail Works, Troy, N. Y., is	1.95
At Albany, N. Y., is	2.32
At Castleton, N. Y., is	2.54
At New Baltimore, N. Y., is	3.43
At Stuyvesant, N. Y., is	3.65
At New York, Governors Island, from Coast Survey	4.38

The mean duration of rise of tide at Albany is 5 hours 0 minutes, and the mean duration of fall 7 hours 25 minutes.

The plane of mean low water at New York (data from U. S. Coast and Geodetic Survey, 1894) is below that—

	Feet.
At Stuyvesant	0.81
At New Baltimore	1.04
At Castleton	1.86
At Albany	2.26
At Troy Nail Works	2.81
At Troy State Dam	4.36

The plane of mean high water at New York is below that—

	Feet.
At Stuyvesant	0.08
At New Baltimore	0.09
At Castleton	0.01
At Albany	0.20
At Troy Nail Works	0.38
At Troy State Dam	0.78

The slope of the plane of mean low water is—

	Feet per mile.
From Troy State Dam to Troy Nail Works	0.51
From Troy Nail Works to Albany	0.12
From Albany to Castleton	0.05
From Castleton to New Baltimore	0.12
From New Baltimore to Stuyvesant	0.06

The heights of the greatest known freshets above the plane of mean low water at Albany are as follows:

That of February 9, 1857, due to an ice gorge at Van Wies Point, was 22.19 feet.

That of October, 1869, due to the great rainfall in that month, which reached 13.8 inches, was 19.04 feet.

That of February, 1886, due to an ice gorge, was 17.89 feet.

That of May 5, 1893, when there was a rainfall of 2.19 inches at Albany in twenty-four hours on the 3d and 4th, was 16.12 feet. In this freshet there was an observed slope of 0.57 foot per mile, on an average, between Albany and New Baltimore, and as much as 0.80 foot per mile between Albany and Van Wies Point.

Generally speaking the effects of rain storms are shown by rise in the river within twenty-four hours. The winds also materially affect the height of water; south and east winds drive the water up the river, causing very high tides, while a north or west wind produces an opposite effect.

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BRIDGES ACROSS THE HUDSON RIVER.

The following table gives the location and essential features of all the bridges which cross the line of navigation of the river:

Name and location of bridge.	Draw span.	Width in clear in each draw.	Height of bottom chord above mean high water.
	Ft. in.	Ft. in.	Ft. in.
New York Central and Hudson River Railroad Bridge at Bridge avenue, Troy, N. Y. *a*	198 6	61 6	23 10
Congress Street Bridge, Troy, N. Y. *b*	258 0	104 0	29 6
New York Central and Hudson River Railroad Upper Bridge, Albany, N. Y. *c*	275 0	110 7	33 5
New York Central and Hudson River Passenger Railroad Bridge, Albany, N. Y. *d*	275 0	115 4	28 1
Lower Bridge, or Greenbush Bridge, Albany, N. Y. *e*	400 0	169 8	22 7
The Poughkeepsie Bridge, Poughkeepsie, N. Y. *f*			160 0

a Railroad, wagon, and passenger bridge; iron, on stone piers; drawpier on land, east shore; the only opening through which boats ply is 56 feet 6 inches in clear from dock line, east shore; draw opened by steam power; 4 piers in main channel of river east of Starbuck Island; respective widths in clear between piers, 170 feet 6 inches, 173 feet 6 inches, 173 feet 6 inches, and 160 feet to east shore line of Starbuck Island; 2 piers in channel of river west of Starbuck Island; width in clear from west shore line of Starbuck Island to first pier, 150 feet 5 inches; between first and second piers, 177 feet 5 inches, and from second pier to Green Island dock line, 68 feet 6 inches, making 6 piers in river at right angles to direction of stream.

b Wagon and passenger bridge; double draw, opened by hand power; iron, on stone piers, slightly oblique to direction of stream; 2 piers and drawpier in river; width in clear from east pier to dock, 205 feet 3 inches; width in clear from west pier to West Troy shore line, 210 feet.

c Railroad freight bridge; double draw, opened by steam power; iron, on stone piers at right angles to direction of stream; 4 piers and drawpier in river between bulkhead lines; respective widths in clear, 148 feet, 170 feet, and 170 feet, commencing at Columbia Pier dock line.

d Railroad and passenger bridge; double draw, opened by steam power; iron, on stone piers at right angles to direction of stream; 4 piers and drawpier in river; respective widths in clear, 146 feet 5 inches, 175 feet, 175 feet, and 119 feet, commencing at Columbia Pier dock line.

e Wagon and passenger bridge; double draw, opened by steam power; iron, on stone piers at right angles to direction of stream; 2 piers and drawpier in river; width in clear from west pier to Quay street dock line, 186 feet 3 inches; width in clear from east pier to shore line pier, 236 feet 3 inches.

f No draw; railroad bridge; iron, on iron piers, with stone foundations, at right angles to stream; 4 piers in river; 5 spans, 548 feet, 525 feet, 546 feet, 525 feet, and 548 feet; cantilever bridge.

In addition to the foregoing the following bridges have been authorized by Congressional or State legislation:

1. Bridge of the North River Bridge Company across the Hudson River at Twenty-third street, New York City.—Authorized by the act of Congress July 11, 1890. The plans, approved by the Secretary of War December 29, 1891, provide for an elevation of 150 feet at mean high water at center and 140 feet at piers. The act provided for commencement of construction within three years from date of passage, and authorized the Secretary of War to extend the time for two additional years. This extension has been granted, but as yet no work of construction has been begun.

2. New York and New Jersey Bridge Company's Bridge, north of Fifty-ninth street and south of Sixty-ninth street, New York City.—By act of Congress approved June 7, 1894, this company was authorized to construct the proposed bridge after approval of location and plans by the Secretary of War. No notice of such approval has been received.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

At the beginning of the fiscal year the following contracts were in force:

Contract with Edwards, Howlett & Thompson, dated December 23, 1892, which provided for the construction of and repairs to 40,000 linear feet of dike, and for the dredging and removing of 4,620,000 cubic yards of material.

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Contract with P. Sanford Ross, dated December 19, 1892, which provided for the removal of 190,000 tons of rock and 30,000 tons of sand covering rock in place.

During the fiscal year the following contract was entered into:

Contract with James J. Cuddy, dated May 2, 1895, providing for the laying of 23,000 square yards, more or less, of paving on the dikes in the Upper Hudson River, New York.

Besides the above the following open-market agreements were made during the fiscal year:

Open-market agreement with William D. Fuller, dated September 22, 1894, for the removal of wreck of old canal boat, below New Baltimore, N. Y.

Open-market agreement with William D. Fuller, dated March 29, 1895, for driving guide piles to define submerged dikes during freshet times.

Open-market agreements with Charles Piepenbrinck, dated April 8 and May 20, 1895, for constructing and putting in place four shelters for self-registering tide gauges.

The sundry civil act of August 18, 1894, appropriated $145,000 for continuing the improvement, which was allotted as follows:

For dredging and construction and repair of dikes under contract with Edwards, Howlett & Thompson	$20,000
For removing rock under contract with P. Sanford Ross	120,000

The sundry civil act of March 2, 1895, appropriated $500,000 for continuing the improvement, which was allotted as follows:

For dredging and construction and repair of dikes under contract with Edwards, Howlett & Thompson	$275,000
For removing rock under contract with P. Sanford Ross	200,000
For laying paving on dikes	25,000

The progress of the work during the season of 1894 was very satisfactory. The work under the contract with Edwards, Howlett & Thompson for the construction and repair of dikes began March 22, 1894, on the reconstruction of the Campbell Island Dike, and good progress was made on this and other dikes until the close of navigation. Since the opening of the river in the spring, the work has been confined to the construction of the Bronks Island Dike, below New Baltimore, and to the reconstruction of the timber work of the Patroons Lower Island Dike.

Good progress was also made with the dredging, as the contractors were able to dispose of the dredged material by dumping behind dikes in the upper sections of the river and in deep side channels below Hudson and Catskill, and also by means of a suction dredge which lifted the material and deposited it behind dikes when there was not sufficient water for dumping scows. In the spring of 1895 the dredging was delayed for want of dumping grounds, most of the space behind dikes where the water was deep enough for scows to float having been filled, but on May 3 use was made of the deep inner channel of the Imbought, and since that time it has progressed very well.

The work under the contract with P. Sanford Ross made very good progress. Two chisel machines were employed during the season on Mulls Rock and Breaker Island Rock, and three dredges worked on Mulls Rock, Austins East Rock, Breaker Island Rock, and reef in front of wharf at Watervliet Arsenal. Since the opening of navigation this spring the work has not been satisfactory. The chisel machines were late in getting on the ground, and, being new, have been subject to constant delays from broken machinery. They are now getting in fair working order, and should make good progress on the Mulls and Breaker Island Rocks, where they are now located.

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The work under the contract with James J. Cuddy for laying paving on dikes in the upper Hudson River was started June 5. The progress so far has been small and not satisfactory, but is improving.

CONSTRUCTION OF NEW DIKES.

Under contract with Edwards, Howlett & Thompson the following dikes have been constructed during the fiscal year:

Bronks Island Dike.—This dike, built on the plan of a full dike, is 12 feet wide and extends from an ice-house dock on the west shore at a point about opposite the lower end of Stone House Bar to the east shore of Bronks Island, a distance of about 6,000 linear feet. Pile driving was started on April 23, 1895, and the dike is still in course of construction.

Houghtailing Island Half Dike.—This is a continuation of the New Baltimore Dike. It is 734 feet long and was built to stop the erosion of the west shore of Houghtailing Island. It was completed November 23, 1895, at a cost of $5.78 per linear foot.

Patroons Lower Island Dike.—This is a reconstruction of the old crib dike on the plan of paved dikes, 20 feet wide, filled in with sand and gravel and paved, the top of the paving being 3 feet above mean high-water level. It starts from Patroons Island and extends southerly about 6,000 linear feet to the old cross dam near the lower end of Patroons Lower Island, and is a continuation of the Pleasure Island Revetment. It was started in 1892, when 300 linear feet was completed. Work was resumed on the pile driving on September 15, 1894, and continued till the close of navigation, when the piling for about 4,000 linear feet and the timbering for 1,000 linear feet was completed. The work of reconstruction is still in progress, having been resumed June 18, 1895.

Base Island Dike.—This is a reconstruction of 5,100 linear feet of an old crib dike built in 1870 on the plan of paved dikes. The piling and timberwork were completed October 8, 1894.

Breaker Island Half Dike.—This dike was in course of construction at the beginning of the fiscal year and was completed August 29, 1894. It extends from the upper end of the revetment of Hillhouse Island to Breaker Island Revetment, a distance of 920 linear feet, and was built at a cost of $3.12 per linear foot.

Breaker Island Revetment.—This revetment, which was in course of construction at the beginning of the fiscal year, was completed October 23, 1894. It was built to protect the east shore of Breaker Island from erosion. The piling which supports the foot of the revetment was driven on the established bulkhead line, and all the points on the shore which projected beyond that line were dredged off and the hollows filled up until the surface on which the paving was laid was sloped away from the piling to the top of the bank with a slope of 1 upon 2. The piling and timberwork of this revetment were completed August 4, 1894. This revetment is 1,990 feet long and varies in width from 33 feet to 25 feet.

REPAIRS TO EXISTING DIKES.

Under contract with Edwards, Howlett & Thompson repairs were made—

To the north end of Coxsackie Island Dike, where the current was fast undermining the piling.

To Schermerhorn Island Dike, to make up for the settlement of the original filling.

To 1,850 linear feet of the Nine Mile Tree Dike.

To 150 linear feet of the New York State Dike, below Castleton, where it had been badly broken by the ice gorge.

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To 520 linear feet of the Castleton Half Dike.
To 1,320 linear feet of the Campbell Island Single Pile Dike.
To 1,600 linear feet of the Douws Point Dike.
To 4,600 linear feet of the Small Island Dike.

Under open-market agreement with William D. Fuller guide piles were driven to mark the following dikes when submerged by freshets: West Dike at New Baltimore, Barren Island Dike, Middle and North Dikes at Coeymans, Mulls Dike, Cow Island Dike, and Cedar Hill Dike.

During the fiscal year a total of 8,556 linear feet of new dike was constructed and repairs made to 10,020 linear feet of dike. The amounts of material furnished and put in place by the contractors were as follows:

301,329 linear feet of pine piling.
12,144 linear feet of round timber.
283,306 feet, B. M., of square timber.
198,246 pounds of tie-rods, screw bolts, drift bolts, spikes, etc.
13,548 cubic yards rubblestone.
6,477 cubic yards paving stone.
22,695 cubic yards of dredged material used for filling and backing dikes.

DREDGING.

There being no complaints of obstructions to navigation on the bars south of Albany the dredging was done on the plan of making a completed channel, according to the present project, of 400 feet width and 12 feet depth at mean low water, working up from deep water, except at Mulls, Austins East Rock, and Breaker Island. At Mulls and Austins East Rock the sand covering the rock was removed. At Breaker Island the point projecting beyond the established bulkhead line was excavated, and a portion of the shoal extending beyond it was also removed. Dredging is now in progress at Coxsackie Shoal, Winnies Bar, Stone Light Shoal, and Cuylers Bar, and was also done during the year at Stone House Bar, New Baltimore Bar, Mulls and Nine Mile Tree Cross Overs, in front of Castleton, at Cedar Hill Bar, on Overslaugh above Stone Light, and opposite Bath above the railroad freight bridge.

The contractors have eight dredges at work on the channel, one dredge delivering the filling for paved dikes, and one suction dredge for lifting and depositing the dredged material behind dikes or dock lines.

The following amounts of material were dredged and removed during the fiscal year:

	Cubic yards.
At Coxsackie Shoal	49,854
At Stone House Bar	76,085
At New Baltimore Bar	61,215
At Mulls Cross Over	164,059
At Castleton Bar	35,895
At Cedar Hill Bar	92,248
At Winnies Bar	158,685
At Stone Light Shoal	315,076
At Cuylers Bar	124,197
At Bath Shoal	3,176
At Breaker Island	45,464
Total	1,125,954

REMOVAL OF ROCK.

Under contract with P. Sanford Ross the work of removing the rock to a depth of 12 feet at mean low water at Mulls Cross Over and Breaker Island, which was in progress at the beginning of the fiscal year, was continued.

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The quantity of rock and sand covering removed during the fiscal year at Mulls Cross Over was 15,899.5 tons of rock and 3,531 tons of sand covering, and at Breaker Island 15,979.4 tons of rock and 3,055 tons of sand covering.

A close survey of Austins East Rock, which was reported as complete in the last annual report, showed considerable rock above the required plane and 756.5 tons of rock were removed. This work was still in progress at the close of the season of 1894 and has not yet been resumed.

The work of removing the rock in front of Watervliet Arsenal Dock to a depth of 10 feet at mean low water, on which some high points were found on a resurvey, was completed by the removal of 65 tons of rock.

This makes an aggregate of 32,700.4 tons of rock and 6,586 tons of sand covering removed during the fiscal year.

PAVING OF DIKES.

Under the contract with James J. Cuddy the work of paving the dikes in the upper Hudson River was begun on June 5, on Base Island Dike, and has proceeded with some interruptions on account of labor. The water in the river has been at such a low stage that everything is favorable for good progress, and the work is being done in a satisfactory manner; 2,151 square yards of paving has been laid and 800 linear feet of dike completed.

WRECKS.

During the fiscal year the wreck of an old canal boat was removed from the channel of the river, below New Baltimore, N. Y., by authority of the Chief of Engineers, dated September 24, 1894, at a cost of $160.

HIRED LABOR.

A foreman and a force averaging 64 men were employed from August 16 to November 30, 1894, in laying the paving of the following dikes: At Patroons Lower Island, 947 linear feet was paved before the close of navigation; at Base Island Dike, 165 linear feet was completed on November 30, 1894, when the work was stopped for the season; at Breaker Island Revetment, which was 1,990 linear feet long and completed October 23, 1894. The cost of this revetment, including piling, timber work, and gravel filling, was $6.28 per linear foot.

HYDROGRAPHIC AND OFFICE WORK.

The hydrographic party has been occupied, when the weather permitted, in making surveys and examinations or in staking out work and putting up ranges for the dredges and rock-breaking machines. The survey of Mulls Rock was completed and borings to develop the rocks in the channel opposite Troy were in progress when the river closed. Resurveys of East Rock at Van Wies Point and of Arsenal Rock were completed. Surveys were also made of Winnies Bar, Stone Light Shoal, the Overslaugh, Bogart Island Cross Over, Cuylers Bar, and Bath Shoal, and an examination of the Imbought Channel, below Catskill, N. Y.; resurveys of Stone House and New Baltimore bars, Mulls and Nine-Mile-Tree cross overs, in front of Castleton, Cedar Hill, and Winnies bars and Stone Light Shoal, where dredging had been done during the year, and a reconnaissance of the channel between

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Stone House Bar and Broadway, Troy, soon after the opening of navigation.

During the winter the force was reduced to an assistant engineer, surveyor, and one draftsman. Notes were platted and tracings and specifications made for the work of the following season. The records of the self-registering tide gauge at Albany were read and reduced, and a table of predicted tides prepared.

GENERAL REMARKS.

The ice in the river, which was very heavy during the winter, broke up very gradually and went out without any gorging, and the heavy freshet of April 9 did no damage to the permanent works except to a portion of the paving on Patroons Lower Island Dike.

The examinations made since the opening of navigation give the following results as to depths over the bars between Stone House Bar, below New Baltimore, and Albany: At Stone House Bar a deph of 11 feet for width of about 200 feet in the narrowest part; at New Baltimore Bar, practically 12 feet, with a width of 200 feet at the narrowest part; at Mulls, where the work of rock removal is still incomplete, 11.5 feet, with a width of about 100 feet in the narrowest portion; from Mulls Cross Over to Castleton, 12 feet depth, with a width generally of 400 feet or more, and not less than 200 feet, except near the lower end of Shad Island, where it is only 11.7 feet for a short distance; in front of Castleton, 11 feet for a width of about 400 feet; from Castleton to Parda Hook, 12 feet and over for a least width of about 200 feet and generally 300 to 400 feet wide; on Winnies Bar, a narrow newly dredged channel of 12 feet depth and over exists, the west side of the channel, dredged to 12 feet during the season of 1894, having shoaled up so as to give now only about 11 feet; at Stone Light the channel is only about 100 feet wide between the 12-foot contours, but for a width of nearly 400 feet the depth is about 11 feet (the rocks at this point have not been entirely removed yet, but there is no known rock above the plane of 10 feet at mean low water), and between Stone Light and the cut to the Abbey and along Overslaugh Dike No. 2 the depth is 12 feet and over for nearly the full width of 400 feet, with the exception of a few shoal spots which have about 11 feet.

Just above Beacon Island for about 1,000 feet in distance is a wide channel about 10 feet deep and thence to the Bogart Island Light a narrow channel of 12 feet and over. No dredging has yet been done on this section.

The shoalest portion from Bogart Island Light to Douws Point has a channel of 10.5 feet depth, with a width of about 150 feet. On Cuylers Bar, where dredging is at present in progress, a channel 200 feet wide and 12 feet in depth has been dredged.

From Albany to Troy no detailed examination of the channel has been made lately, except of shoal opposite Bath, where the greatest depth is about 9 feet and the channel very narrow. About 8 feet depth at mean low water seems to be the shoalest, but owing to extraordinary low tides for the season, some trouble has been experienced already by the large boats, and temporary relief will probably have to be given by some dredging on Kellogg and Fish House shoals.

Each succeeding year shows the necessity for larger and more urgent repairs to the old dikes. To preserve the integrity of this part of the improvement, repairs next season should be carried on along the following sections: Stone filling is needed to Mulls Plaat Dike extension,

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to Mulls Stone Dike, and Mulls Timber Dike; new timber and stone at Cedar Hill Dike, in front of Poplar Island, to Cow Island Single Pile Dike, and Campbell Island Single Pile Dike, and the two last should be reconstructed on the plan of full dikes, to Winnies Dike, where new timber work and stone are needed, and probably a few piles; the Papscanee dikes should be repaired, and the openings between the sections of dikes should be closed, so as to form a continuous dike, and it seems highly probable that an extension of the Papscanee Dike Section III about 2,000 or 3,000 feet farther south will be necessary; Overslaugh Dike needs repair for about 700 feet, and Bath Dike should be filled with stone; the Fort Schuyler Dike paving should also be put in good order. The amount that could be profitably expended on these repairs is $70,000.

It is still a question whether the channel at New Baltimore Bar, north of Willow Island Light, will be able to maintain itself without some contraction of the width. The latest soundings indicate the tendency to the formation of a shoal all the way across the channel just below the angle in the west dike. At present the depth is slightly less than 12 feet.

The channel east of Willow Island has shoaled a good deal since last fall, but still maintains 8 feet depth all the way from the New Baltimore Dike to Willow Island. It may be necessary to close this channel by a riprap spur connecting Willow Island with the east bank of the river.

The amount expended during the fiscal year ending June 30, 1895, inclusive of outstanding liabilities, was $582,428.85.

The amount that can be profitably expended during the fiscal year ending June 30, 1897, is $500,000.

This improvement has been under the local charge of Mr. Charles G. Weir, assistant engineer, to March 1, 1895, and since then of Mr. R. H. Talcott, assistant engineer, both of whom have well and faithfully discharged the duties assigned to them.

This work is in the collection district of New York, Albany being a port of entry.

AMOUNTS APPROPRIATED.

Act of—		Act of—	
June 30, 1834	$70,000.00	August 30, 1852	$50,000.00
July 2, 1836	100,000.00		
March 3, 1837	100,000.00	Total	420,000.00
July 7, 1838	100,000.00		

AMOUNTS APPROPRIATED FOR PRESENT PROJECT AND ITS CONTINUATION.

Act of—		Act of—	
June 26, 1864, allotment	$33,000.00	July 5, 1884	$30,000.00
June 23, 1866	50,000.00	August 5, 1886	26,250.00
March 3, 1867	305,188.00	August 11, 1888	75,000.00
July 25, 1868	85,000.00	September 19, 1890	150,000.00
April 10, 1869	89,100.00	July 13, 1892	187,500.00
July 11, 1870	40,000.00	March 3, 1893	500,000.00
March 3, 1871	40,000.00	August 18, 1894	145,000.00
June 10, 1872	40,000.00	March 3, 1895	500,000.00
March 3, 1873	40,000.00		
June 23, 1874	40,000.00	Total	2,611,038.00
March 3, 1875	40,000.00	Received from other sources	792.57
August 14, 1876	50,000.00		
June 18, 1878	70,000.00	Total	2,611,830.57
March 3, 1879	30,000.00	Amount expended to June 30, 1895, inclusive of outstanding liabilities	2,085,233.07
June 14, 1880	20,000.00		
March 3, 1881	15,000.00		
August 2, 1882	10,000.00		

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Money Statement.

July 1, 1894, balance unexpended		$464,026.35
Amount appropriated by sundry civil act approved August 18, 1894		145,000.00
Amount appropriated by sundry civil act approved March 2, 1895		500,000.00
		1,109,026.35
June 30, 1895, amount expended during fiscal year		470,259.20
July 1, 1895, balance unexpended		638,767.15
July 1, 1895, outstanding liabilities	$112,169.65	
July 1, 1895, amount covered by uncompleted contracts	509,065.09	
		621,234.74
July 1, 1895, balance available		17,532.41
Amount (estimated) required for completion of existing project		1,115,406.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		500,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for laying paving on dikes in the Hudson River, New York, received in response to advertisement, dated March 15, 1895, and opened April 15, 1895, by Lieut. Col. G. L. Gillespie, Corps of Engineers.

No.	Name of bidder.	Laying 23,000 square yards of paving.	
		Per square yard.	Amount.
		Cents.	
1	Thomas Reilly	29	$6,670
2	Oscar F. Hilt	45	10,350
3	James J. Cuddy *	21	4,380

* Lowest bid.

COMMERCIAL STATISTICS.

The importance of the Hudson as a great waterway of commerce is apparent when it is known that aside from its own local traffic, which in itself is very large, it absorbs all the traffic of the Erie, Champlain, and Delaware and Hudson canals, besides the great coal trade of the Pennsylvania Coal Company at Newburg and the Erie coal trade at Piermont. The average season of navigation of the river is 240 days and that of the canals 220 days.

The Erie Canal, extending from Albany to Buffalo, on Lake Erie, a distance of 352 miles, with a difference of level of 577 feet, and to Oswego, on Lake Ontario, connects the Great Northern Lakes with the Hudson River, and brings in immense commerce from the Northwest and Canada. The principal items of this commerce are lumber and grain.

The Champlain Canal, 60 miles long, connects Lake Champlain with the Hudson River. This lake, which is 93 feet above tide of the Hudson, and whose waters flow into the St. Lawrence, is connected by the Chambly Canal with the St. Lawrence River below Montreal. The principal items of tonnage on this canal are lumber and iron ore. The above canals, with 575 miles of subsidiaries, constitute the New York State canals. The Erie Canal enters the Hudson by three tide-water locks, one at the foot of Twenty-third street, West Troy; one at the foot of Eighth street, West Troy, and the third at the lumber district, Albany.

The Champlain Canal enters the river at Waterford 3 miles above the State Dam, and boats are locked through the dam to tide water. It is also connected with the Erie Canal, and, through its tide-water locks, with the Hudson River.

The Delaware and Hudson Canal enters the Hudson through Rondout Creek at Rondout, N. Y., and brings the anthracite coal country at Honesdale and the Dela-

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ware River into water communication with the Hudson. The principal items of tonnage on this canal are coal, bluestone, and cement. Aside from the above feeders to the commerce of the Hudson, the Pennsylvania Coal Company has a large tide-water coal depot at Newburg, where also the Erie Railroad has a terminal point and transfers large quantities of freight by boat across the river. The Erie Railroad also has a coal depot at Piermont, 20 miles above New York, where preparations are being made to handle a very large supply.

The following statistics include the tonnage received at all points above Spuyten Duyvil Creek, and of the local shipments between points on the river only that shipped is credited to the points from which it was shipped, no entry being made to the total tonnage of the amount received at local points from other local points. The total tonnage also includes all through freights shipped from points up the river that passed the mouth of Spuyten Duyvil Creek going south.

The two principal industries on the river which add materially to the local tonnage are ice and brick. The capacity of the ice houses on and adjacent to the river exceeds 4,000,000 tons, and amount generally harvested 3,500,000. The brick manufactured on the river exceed 850,000,000.

Total tonnage of all shipping points on the Hudson River during 1889, not including the tonnage coming through State canals.....tons..	15,033,309
Value of same	$378,196,094
Total tonnage coming to and leaving tide water through State canals, 1889.....tons..	3,592,437
Value of same	$108,000,000
Grand total tonnage of the Hudson River, including the tonnage through State canals.....tons..	18,582,596
Value of same	$485,733,094

This does not include the value of vessels carrying the above trade, which are equally exposed to the dangers of navigation.

Number of transportation companies for passengers or freight, not including steamboats or pleasure boats.....	30
Total number of passengers carried, 1889.....	5,000,000
Total population along the river.....	450,000

COMMERCIAL STATISTICS.

Commercial statistics of the port of Albany, N. Y., from July 1, 1894, to July 1, 1895.

Amount of revenue collected.....	$114,019.70
Value of all imports	153,905.00

Number and tonnage of all vessels belonging to the port of Albany, N. Y., July 1, 1895.

	Number.	Registered tonnage (net).
Steam vessels.....	113	20,417.47
Sailing vessels.....	27	2,001.82
Barges.....	54	11,145.16
Canal boats.....	161	15,624.66

E 2.

IMPROVEMENT OF HARBOR AT SAUGERTIES, NEW YORK.

The harbor of Saugerties is at the mouth of Esopus Creek, which empties into the Hudson River on the west shore about 100 miles above the city of New York. With the exception of some slight works undertaken by the inhabitants, giving no permanent results, nothing had been done toward the improvement of this harbor until it was undertaken by the United States Government in 1887. In 1883 a survey of the harbor was made, under the direction of the engineer officer in charge, which indicated that there was a shoal at the entrance 1,100 feet wide between 6-foot contours, over which the least depth was 3 feet. mean low water. Two plans of improvement were recommended, both

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providing for the construction of parallel dikes and for dredging the channel between them 7 feet deep, mean low water. (See Annual Report of the Chief of Engineers for 1884, Part I, p. 716.)

The reexamination of the harbor, made in 1887, after the State had done some dredging in the channel, resulted in the submission of a third project, differing from those previously submitted only in the direction to be given to the dikes. The range of tides is 4 feet, approximately.

The project of 1887 was approved and its execution was begun the same year. (See Annual Report of the Chief of Engineers for 1887, Part I, p. 662.)

The estimated cost of construction of north and south dikes, each 2,300 feet long, and for excavating from the channel between them 30,000 cubic yards of material, was $52,000.

The purpose of the dikes is to contract the channel, to promote scour by freshets, and to maintain the improved navigable depths during the low stage of summer, which usually lasts for two months, approximately.

At the close of the fiscal year ending June 30, 1892, both dikes had been completed; the north dike had then a length of 2,058 feet and the south dike a length of 2,363½ feet, and the waterway between them was 260 feet wide.

The inner harbor, west of the shore ends of dikes, was 2,000 feet long, 150 feet wide, and 14½ to 20 feet deep at mean low water. From the steamboat wharf of inner harbor to the Hudson River the navigable channel had been deepened by dredging, giving a width of 150 feet between 9-foot curves.

The river and harbor act of July 13, 1892, appropriated $5,000 for continuing the improvement, of which sum $2,340 was applied toward repair of dikes and $2,660 to drilling, blasting, and dredging rock from the northern end of Barclays Point. By the latter improvement the channel was widened to the southward 68 feet and deepened to 9 feet at mean low water, affording a much-desired relief to the navigation of the inner harbor.

The amount expended during the fiscal year ending June 30, 1894, exclusive of outstanding liabilities, was $2,626.47.

As the direct result of improvements which have been made by the Government, vessels drawing 12 feet and upward can reach the factories located on the inner harbor at high tide.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

The river and harbor act of August 17, 1894, appropriated $5,000 for the completion of the improvement.

No work has been done during the fiscal year ending June 30, 1895, except an examination of the channel and dikes early in the month of May, when about 200 feet of the north dike was found to be badly undermined by the heavy spring freshets. It being a case of emergency, proposals for repairs were invited according to law, and the work awarded to Mr. W. D. Fuller, of New Baltimore, N. Y., who was the lowest bidder. As yet no work has been done except the collection of material.

The general condition of the dikes was found to be fair, though the timber work is deteriorating above the high-water level.

The channel between the dikes is now 8 feet deep at mean low water for a width of not less than 200 feet at any point.

The removal of a portion of the rock at Barclays Point has relieved navigation somewhat, but the formation of a shoal just above it, on the

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north side of the creek, makes it difficult for the steamboats to make the turn at this point without striking either the rocks or the shoal, the bend in the creek being very sharp.

A large sand bar in the upper part of the creek, formed by the freshet this spring, which was unusually heavy, is an obstruction to boats going to the Barclay Fiber Company's mills. Other parts of the channel are very deep, and the section within the works of improvement is better than ever before.

The amount expended during the fiscal year ending June 30, 1895, inclusive of outstanding liabilities, was $125.33.

The amount estimated to be required to complete the project of 1887 has all been appropriated, and if the improvement is to continue a new project, with estimate of cost, will be required.

In the meanwhile it is expedient to provide means for keeping in good repair the works of improvement and for removing from the improved channel such deposits as may be made annually by the spring freshets.

For this purpose the sum of $5,000 is recommended for the fiscal year ending June 30, 1897.

Saugerties is in the collection district of Albany, N. Y., which is the nearest port of entry. The nearest light-house is at the mouth of Esopus Creek.

AMOUNTS APPROPRIATED.

Act of—	
July 5, 1884	$5,000.00
August 5, 1886	15,000.00
August 11, 1888	12,000.00
September 19, 1890	10,000.00
July 13, 1892	5,000.00
August 17, 1894	5,000.00
Total	52,000.00
Amount expended to June 30, 1895, inclusive of outstanding liabilities	46,934.58

Money statement.

July 1, 1894, balance unexpended	$190.75
Amount appropriated by act of August 17, 1894	5,000.00
	5,190.75
June 30, 1895, amount expended during fiscal year	125.33
July 1, 1895, balance unexpended	5,065.42
July 1, 1895, amount covered by uncompleted contracts	1,134.00
July 1, 1895, balance available	3,931.42
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	5,000.00

Abstract of proposals for improving harbor at Saugerties, N. Y., received in response to public notice dated May 29, 1895, and opened June 8, 1895, by Lieut. Col. G. L. Gillespie, Corps of Engineers.

No.	Name of bidder.	Yellow pine square timber (1,000 feet, B. M.).		Tie-rods (300 pounds).		Broken stone (1,200 cubic yards).		Total.
		Per 1,000 feet, B. M.	Amount.	Per pound.	Amount.	Per cubic yard.	Amount.	
1	William D. Fuller	$48.00	$48.00	$0.06	$18.00	$0.89	$1,068.00	*$1,134.00
2	William Parrott	50.00	50.00	.06	18.00	1.05	1,260.00	1,328.00
3	John E. Pidgeon	55.00	55.00	.06	18.00	1.30	1,560.00	1,633.00

* Lowest bid.

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COMMERCIAL STATISTICS.

The commercial carriers are 5 steamboats for freight and passenger traffic, owned by the Saugerties and New York Steamboat Company, the Saugerties and Albany Line, and the Saugerties, Rondout and Hudson Line; and 405 sailing and other craft, the former carrying 17,000 passengers annually, and in all aggregating 189,000 tons of freight, valued at $5,484,000, the principal products being general merchandise, bluestone, coal, and lumber.

The population of Saugerties is 5,000.

E 3.

IMPROVEMENT OF HARBOR AT RONDOUT, NEW YORK.

The harbor of Rondout is at the mouth of Rondout Creek, which empties into the Hudson River on its west side, about 90 miles above the city of New York.

From the entrance to the first lock of the Delaware and Hudson Canal, a distance of 3 miles, the creek is a tidal stream, the range of tides being 4 feet approximately.

Prior to 1871 improvements had been made by private persons and corporations, but no permanent benefit had been derived from them. In 1869 a survey of the harbor was made by the Government with a view to its permanent improvement, and it was then found that the available depth of water in the channel was about 7 feet.

The project of improvement, based upon this survey, provided for the formation and maintenance of a channel 100 feet wide and 14 feet deep at the mouth of the creek, to be obtained by means of dredging and diking. Two parallel channel dikes were to be built outward, toward and into the Hudson River, their outer ends curving gently downstream, while a branch dike running upstream along the Hudson from the outer end of the north dike was to protect that dike from destruction by running ice. The estimated cost of the work was $172,500.

The final length of the north and south dikes was to be determined after observing the effects which they might produce in the removal of the bar as they were gradually extended outward. The work was begun in 1872 and was completed in 1880. It was found by experience that the dikes might be made shorter than originally deemed necessary, and the total cost of the work reduced to $90,000, less than two thirds of the original estimate.

On the completion of the work in 1880 the north dike was 2,200 feet, approximately, with a branch dike running up the Hudson 1,000 feet, approximately, and the south dike was 2,800 feet long, approximately, with a spur to the light-house 330 feet long. The distance between the dikes at the entrance was 350 feet, approximately. As the result of the works of improvement there was a channel over the bar from the creek to the Hudson River 50 feet wide, giving 13½ feet mean low water; 100 feet wide, giving 12 feet mean low water, and 200 feet wide, giving 10 feet mean low water. At the outer end of the dikes the distance between the 12-foot curves was over 300 feet.

The north and branch dikes were originally built to the height of mean high water, while the south dike, for 500 feet west of the light-house, was built only to the level of the half tide. The low part of the south dike was subsequently raised by crib work to mean high water, but even with this increased height the dikes are submerged during storm tides and freshets, and are required to be marked by fender piles to

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enable vessels to enter the harbor at such times without danger of being wrecked upon the concealed dikes.

The appropriations for this harbor made since the completion of the works in 1880 have been applied exclusively to the repair of the dikes. The improved depths in the channel have been well maintained, but the dikes have greatly deteriorated, partly owing to the ice, partly to the natural decay of the timber, and partly to the undermining of the piles by scour.

The survey of the harbor in September, 1889, indicated a continued improvement of the channel between the dikes, not in the enlargement of the width of the 14-foot channel, but in that of the 9-foot channel, which then had a width of 250 feet.

On the south side of the entrance there had been a slight shoaling, due probably to the removal in 1884 of 150 feet from the outer end of the south pier to meet the wishes of the boatmen, who alleged that their tows required a wider entrance between the piers on that side when coming in with vessels on flood tide. The change in length of the south dike doubtless facilitates entrance at flood tide, but the shoaling of the bar on that side, which is shown by the survey of 1889, makes it probable that the south dike should be increased rather than decreased in length.

The river and harbor act of September 19, 1890, appropriated $5,000 for repairing existing works, which was expended in repairs to the north and branch dikes. This work was completed October 28, 1891.

The river and harbor act of July 13, 1892, made an appropriation of $5,000 for repairs to existing works, which was expended in repairs to the north branch dike and the rebuilding of 350 feet of the south dike.

The amount expended in the fiscal year ending June 30, 1894, was $3,256.89.

In the Annual Report of the Chief of Engineers for 1889, Part I, page 765, it was stated that complaint had been made that a narrow shoal existed on the inside, 1¾ miles from the light-house, composed chiefly of rock or large bowlders, over which there was a depth of from 5½ to 6 feet, and that it should be removed to a depth of 10 feet. This was again referred to in the Annual Report for 1890, page 703, and its removal recommended. In the Annual Report for 1891, page 884, it was stated, on the assurance of the State officials, that this rock and shoal had been removed by the State of New York during the fall of 1890. Investigation and examination by this office made in 1894 show that this rock and shoal have been removed only in part. The rock lies in mid-channel, near South Rondout Ferry, and has a least depth of 7.4 feet over it, and the shoal extends from the ferry 1,500 feet eastward, with an average depth of only 8 feet. As the channel is only about 70 feet wide, both rock and shoal are very serious obstructions, and their removal to a depth of 12 feet at mean low water is recommended.

The channel maintains itself in good navigable condition, sufficient for the wants of commerce. While the dikes are in good condition of repair, they are much exposed to damage by ice in the river and by boats that frequently run into and break down the timberwork at the intersection of the north and branch dikes.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

The river and harbor act of August 17, 1894, appropriated $5,000 for maintenance.

No work has been done during the fiscal year ending June 30, 1895.

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Sealed proposals for the construction of about 200 feet of dike, which were invited by advertisement according to law, were opened October 30, 1894, and the contract was awarded to Richard Parrott, and signed December 11, 1894.

The contract called for the furnishing of the material in place for the extension of the south dike at the mouth of the creek, about 200 feet, and for white-oak fender piles for its protection. Work was to have been begun on or before June 1, 1895, but, on application of the contractor, the time for starting the work was postponed until July 1, 1895.

A comparison of the latest survey, made in 1891, with the former surveys shows that the channel had remained about in the same condition year after year, except at the entrance, where a very great change had taken place between 1884 and 1889, which has been ascribed to the removal of the south dike.

The amount expended during the fiscal year ending June 30, 1895, inclusive of outstanding liabilities, was $41.34.

The sum of $10,000 can be profitably expended during the fiscal year ending June 30, 1897, in extending the south dike, in maintaining the north and south dikes, in dredging shoals at entrance of harbor and channel from South Rondout Ferry eastward, and removing rock near South Roudout Ferry.

This amount will, if appropriated, complete the sum estimated to be required for the execution of the project of 1872, and if the improvement is to continue thereafter a new project, with estimate of cost, will be required.

Rondout is in the collection district of New York. The nearest works of defense are those in New York Harbor.

AMOUNTS APPROPRIATED.

Act or allotment.	Application.	Amount.
Act June 12, 1872	Diking	$10,000.00
Act March 3, 1873	do	20,000.00
Allotments June 8, 1875:		
From repairs of harbors on Atlantic coast	Repairs	762.18
From contingencies of rivers and harbors, etc	do	237.82
Act August 14, 1876	Diking and repairs	30,000.00
Act June 15, 1878	Diking and dredging	30,000.00
Act August 2, 1882	Repairs and dredging	2,000.00
Act July 5, 1884	do	1,000.00
Act August 5, 1886	Repairs	2,500.00
Act August 11, 1888	do	5,000.00
Act September 19, 1890	do	5,000.00
Act July 13, 1892	do	5,000.00
Act August 17, 1894	do	5,000.00
Total		116,500.00
Amount expended to June 30, 1895, inclusive of outstanding liabilities		$111,541.34

Money statement.

Amount appropriated by act of August 17, 1894	$5,000.00
June 30, 1895, amount expended during fiscal year	41.34
July 1, 1895, balance unexpended	4,958.66
July 1, 1895, amount covered by uncompleted contracts	2,212.20
July 1, 1895, balance available	2,746.46
Amount (estimated) required for completion of existing project	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

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Abstract of proposals for improving harbor at Rondout, N. Y., received in response to advertisement dated September 24, 1894, and opened October 30, 1894, by Lieut. Col. G. L. Gillespie, Corps of Engineers.

No.	Name of bidder.	Constructing extension of the South Dike.					
		Pine or spruce piles (8,640 linear feet).		White-oak piles (350 linear feet).		Yellow pine square timber (8,700 feet, B. M.).	
		Per linear foot.	Amount.	Per linear foot.	Amount.	Per M. feet, B. M.	Amount.
1	Joseph L. Powley	$0.13	$1,123.20	$0.20	$70.00	$40.00	$348 [illegible]
2	Richard Parrott	.14	1,209.60	.20	70.00	38.00	33 [illegible]
3	Frederick J. Kelly	.18	1,555.20	.25	87.50	47.00	4 [illegible]
4	Frank Pidgeon	.28	2,419.20	.38	133.00	40.00	348
5	William Parrott	.13	1,123.20	.25	87.50	40.00	348 [illegible]

No.	Name of bidder.	Constructing extension of the South Dike.						Total.
		Tie-rods and screw bolts (3,400 pounds).		Drift bolts, spikes, washers, chain, or cable (600 pounds).		Rubblestone for filling (600 cubic yards).		
		Per pound.	Amount.	Per pound.	Amount.	Per cubic yard.	Amount.	
1	Joseph L. Powley	$0.06½	$221.00	$0.05	$30.00	$0.95	$570.00	$2,362 [illegible]
2	Richard Parrott*	.05	170.00	.03	18.00	.69	414.00	2,212 [illegible]
3	Frederick J. Kelly	.04½	153.00	.04½	27.00	.97	582.00	2,815 [illegible]
4	Frank Pidgeon	.04	136.00	.04	24.00	1.50	900.00	3,960 [illegible]
5	William Parrott	.04½	153.00	.04½	27.00	1.10	660.00	2,398 70

* Lowest bid.

COMMERCIAL STATISTICS.

The commercial statistics of this harbor have not changed materially since report for 1890, at which time there was a total tonnage of 2,467,490 tons, valued at $11,268,850. General merchandise, coal, cement, lime, bluestone, and ice are the principal products handled, and are carried in about 700 vessels, which also carry 75,000 passengers annually.

Of the above tonnage one-half passes through the Delaware and Hudson Canal, which connects the Hudson River at Rondout with the Delaware River at Port Jervis, N. Y., and with Honesdale, Pa., the heart of the Pennsylvania coal region.

The population of Rondout is 25,000.

E 4.

IMPROVEMENT OF WAPPINGER CREEK, NEW YORK.

Wappinger Creek is a small stream which rises in the northern part of Dutchess County, N. Y., near the boundary with Columbia County, and after flowing for about 40 miles through a rich, fertile valley, empties into the Hudson River on the east bank one-half mile below the village of New Hamburg, N. Y.

The appropriation of $13,000 contained in the river and harbor act of September 19, 1890, is the first ever made by the Government for the improvement of the stream, and is based upon the estimate contained in the report, November 11, 1889, upon the survey of Wappinger Creek from Wappingers Falls to its mouth, made to comply with the river and harbor act of August 11, 1888.

At the time of the survey the creek was navigable for vessels and small barges drawing not over 6 feet, in a channel varying in width from 25 to 75 feet to Wappingers Falls, 2 miles, approximately, above

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its mouth, where a series of falls, with an aggregate height of 86½ feet above mean low water, furnish a valuable water power for three industries, the principal of which is the print works of the Dutchess Company.

The project of improvement contemplated a channel 80 feet wide and 8 feet deep from the mouth to the head of navigation at the falls, and the quantity of material required to be excavated was estimated at 45,000 cubic yards.

At the close of the fiscal year ending June 30, 1892, not only was the project completed, but additional navigable facilities had been given at the head of navigation by opening a channel 40 feet wide and 8 feet deep from deep water of the main branch of the creek to the Wappinger town dock.

The channel in its present condition meets, it is believed, all the wants of commerce.

Wappinger Creek is in the collection district of New York. The nearest works of defense are situated upon Governors Island, New York Harbor, and the nearest light-house is Danskammer Point Light-House.

Money statement.

Amount appropriated September 19, 1890	$13,000.00
Amount expended to June 30, 1895	13,000.00

COMMERCIAL STATISTICS.

The principal manufactures at the Falls are cotton goods, overalls, clothing, combs, and iron. They are mostly transported by small boats to the mouth of the creek inside of the railroad bridge, where they are transferred to the New York Central and Hudson River Railroad.

The tonnage of the creek during the year 1888 was 70,000 tons. The value of the tonnage was then estimated at $6,500,000. The Dutchess Company shipped 15,500 tons at an estimated valuation of $5,600,000. The traffic is principally carried by sloops, schooners, scows, canal boats, and barges.

E 5.

IMPROVEMENT OF HARLEM RIVER, NEW YORK.

The project for making a navigable water connection between the East River and the Hudson River, by the way of the Harlem River and Spuyten Duyvil Creek, was formulated upon the facts determined by the survey made along this route in 1874, in compliance with the river and harbor act of June 23, 1874, the report upon which may be found on page 224, Annual Report of the Chief of Engineers for 1875, Part II.

This report contains an interesting historical review of the navigation of the Harlem River from the Revolution to the present time.

A full history of this improvement, as now adopted, with the legal proceedings for the acquirement of the land needed for it, and copies of the laws passed by the legislature of the State of New York relative thereto, is given in the annual report of the local engineer in charge to the Chief of Engineers for 1887. (See Annual Report of the Chief of Engineers for 1887, Part I, pp. 665 to 689.)

The streams embraced in the improvement are the Harlem River and Spuyten Duyvil Creek, the former emptying into the East River near Hell Gate, and the latter into the Hudson River about 13 miles north of the Battery, and the two together separating Manhattan Island from the mainland.

There has always been an exchange of waters between these two streams at Kingsbridge, though a long ledge of rocks awash at mean

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low water and an extremely narrow channel at that point have heretofore prevented the exchange being a free one.

High Bridge was originally the head of navigation in the Harlem River, but there was a fair channel of about 10 feet depth at mean low water as far as Morris Dock, 6 miles from the mouth of the river, and a crooked one of 7 feet depth to Fordham Landing, 1 mile farther; there was no navigation of this latter section, except by rowboats or by small boats used for transporting building material to the "annexed district." Kingsbridge, 1½ miles from the Hudson River, was the head of navigation in Spuyten Duyvil Creek, but only at high water for vessels drawing 8 feet.

The range of the tides in Harlem River varied from 5.5 feet at Third Avenue Bridge to 6 feet at the mouth of Dyckman Creek, and in the Spuyten Duyvil Creek was 3.8 feet.

As the difference in the height and times of tides between the East and Hudson rivers, after connection has been made between the Harlem and the Hudson rivers, will produce the currents upon which reliance is placed to keep the channel open, it was desirable that the cross section of the channel be kept as uniform as possible, in order to avoid the unnecessary resistances to the flow of the water which will be caused by any contraction of the waterway.

With this view the contraction of the proposed cut through Dyckman Meadow will be more than counterbalanced by the natural channel through Spuyten Duyvil by the way of Kingsbridge, which is left open, and the contraction caused by the piers and embankments of High Bridge, which carries the Croton Aqueduct across the Harlem River, will be compensated for by deepening the channels between the piers and abutments of that bridge.

Observations of the tides affecting these waters show that there is not a free exchange of tides between Harlem River and Spuyten Duyvil Creek, but that there is practically a divide somewhere near Fordham Bridge between the tides flowing from the East River into the Harlem River and from the Hudson River into Spuyten Duyvil Creek. Comparing the tides of the Harlem River at Fordham Bridge with those of the Hudson River at the mouth of the Spuyten Duyvil Creek, it is found—

(1) That the level of mean high water in the Hudson is nearly 1 foot (0.961 foot) lower than it is in the Harlem.

(2) That the mean rise and fall of the tide in the Hudson is 2.12 feet less than it is in the Harlem.

(3) That the mean duration of the rise of tides in the Hudson is thirty-six minutes shorter and the mean duration of the fall twenty-six minutes longer than in the Harlem.

(4) The mean level of the Hudson at the mouth of the Spuyten Duyvil Creek is 0.265 of a foot lower than at Fordham bridge.

(5) High water occurs one hour and thirty-four minutes earlier in the Hudson than in the Harlem.

From these facts it follows that while on the opening of the new channel through Dyckman Meadow there will be a free flow east or west dependent upon the stage of the tides, the preponderance will be westward, and that the mouth of the improved channel will then be at the junction with the Hudson River.

The project for the improvement was adopted in 1879. The proposed lines of improvement, as laid down by the engineer in charge in his annual report for 1882, are as follows:

(1) Below the Harlem or Third Avenue Bridge the outer pier and bulkhead lines as laid down by the park department are adopted.

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(2) Above the Third Avenue Bridge to the entrance of Dyckman Creek into the Harlem River the exterior pier and bulkhead lines are laid down 400 feet apart.

(3) The line following Dyckman Creek through Dyckman Meadow will pass for a part of the way through solid rock, and it is here that the principal cost of the undertaking must be encountered. This part is to be made 350 feet wide. It would have been preferable to have established it at 400 feet, but the additional amount of rock excavation was the obstacle.

(4) The remainder of the line to the Hudson River will follow, as nearly as possible, the course of the Spuyten Duyvil, and the width will be 400 feet.

(5) The channel depth in the Harlem River and Spuyten Duyvil Creek will be 15 feet at mean low water, and in the channel along Dyckman Creek 18 feet mean low water.

The cost of opening a navigable waterway from the Hudson River through Dyckman Creek to the Harlem River at East Two hundred and eighteenth street, New York City, was estimated in 1875 at $2,100,000, and for dredging the Harlem River thence to Third avenue at $600,000 additional, making the estimated aggregate cost of the improvement $2,700,000.

The project was revised in 1886 by narrowing the channel immediately north of High Bridge to 375 feet where it skirts the Ogden estate, on the east bank. This change of width was approved by the Secretary of War October 7, 1886. (See Annual Report of the Chief of Engineers for 1887, Part I, p. 671.)

The legal difficulties for acquiring the right of way along the line of the proposed improvements from the Harlem River to the Hudson River, through Dyckman Meadow, were removed in May, 1887, and immediately thereupon the appropriations of 1878 and 1879, aggregating $400,000, became available, and the project for their expenditure was begun and continued under succeeding appropriations.

The work contemplated by available balances provides for the completion of the artificial cut through Dyckman Creek, and the removal of the debris of the two dams built in aid of its construction; for the deepening of the channel, by dredging from the east dam through the Harlem River to Washington Bridge, and from the west dam to the Hudson River, and for the removal of the rocky reef at the foot of One hundred and twenty-second street, locally known as Candle Factory Reef, and the widening of the channel on the opposite side of the river by the removal, by dredging, of the shoal at the northwest corner of Randall Island.

When these several improvements are effected, during the year 1895–96, it is expected that there will be a connecting channel 150 feet wide between the Hudson and East rivers, navigable at mean low water by vessels drawing 12 feet.

By act of Congress approved March 3, 1881, a survey was made of the Harlem or Bronx kills, north of Randall Island, and a report was submitted upon the practicability of opening a channel 300 feet wide and 15 feet deep, mean low water, between the East River and the Harlem River by this route, at an estimated cost of $2,000,000. The report will be found in the Annual Report of the Chief of Engineers for 1882, Part I, page 656. The project was never approved by Congress, and no appropriation has ever been made for its execution.

Harbor lines for the preservation and protection of the navigable waters of the Harlem River and Spuyten Duyvil Creek were established

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by the Secretary of War October 18, 1890, under authority of the river and harbor act of August 11, 1888.

The department of public parks, New York City, made application to the Secretary of War, July 11, 1893, for a modification of the harbor line of the west bank of the Harlem River from near High Bridge to and beyond the Washington Bridge, to enable an adequate highway to be built along the Harlem River, connecting One hundred and fifty-fifth street with the northern end of Manhattan Island.

The matter was submitted to the Harbor Line Board for New York Harbor and adjacent waters, and on its recommendation the Secretary of War authorized, October 2, 1893, a modification of the harbor line as follows:

Beginning at a point "A" on the harbor line on the west bank of the Harlem River, established by the Secretary of War, October 18, 1890, 741 feet south of the center line of the western abutment of Washington Bridge, the recommended line runs thence northerly in a straight course, a distance of 1,630 feet, to a point "B" in the said harbor line, 889 feet north of the center line of said western abutment. The coordinates of the point "A" are north 6,180.03 and east 741.48, and those of point "B" are north 7,806.61, and east 708.37, the origin of coordinates being the southeast corner of Tenth avenue, at its intersection with One hundred and fifty-fifth street, New York City. The modified line so drawn will pass to the eastward of the eastern face of the western abutment of Washington Bridge a distance of 62 feet, approximately, and eastward of the established harbor line at that point a distance of 21 feet.

The modification of the harbor line was accompanied with the permission to the department of public parks to build an iron footway 12 feet in width, carried around the river side of the outer pier of the bridge known as "High Bridge," across the Harlem River, at New York City, N. Y., said pier being situated upon the western pierhead and bulkhead line along said river.

BRIDGES ACROSS THE HARLEM RIVER.

The following table shows the location and characteristics of the several existing bridges across the Harlem River:

Name and location of bridge.	Width in clear in each draw.	Height of bottom chords above mean high water.	Remarks.
	Feet.	*Feet.*	
Second avenue	103.7	28.5	Double draw, railroad bridge, iron.
Third avenue (temporary)	61	4	Double draw, wooden trestle, iron drawspan.
Fourth avenue (temporary)	60	1	Single draw, wooden trestle, iron drawspan.
Madison avenue	132	28	Double draw, road bridge, iron.
Macomb Dam, One hundred and fifty-fifth street.	164	28	Double draw, road bridge, iron, opened to traffic May 1, 1895.
Macomb Dam, One hundred and fifty-sixth street (temporary).	76	16.7	Double draw, road bridge, wood; will shortly be removed; draw permanently open at present.
New York and Northern Railway Bridge, at Eighth avenue.	128	28	Double draw, railroad bridge, iron.
High Bridge (old aqueduct)	.....	.....	No draw; stone arch; width between piers, 77.7 feet; clear waterway, 55 feet; crown of arch, 100 feet above mean high water.
Washington Bridge, at One hundred and eighty-first street.	.....	Single span.	No draw; iron arch; span, 500 feet; clear waterway, 420 feet; crown of arch, 136.7 feet above mean high water.
Farmers Bridge	.....	3.1	No draw; two spans, 22 and 23 feet wide; light timber structure.
Kings Bridge	.....	4.8	No draw; two spans, 18 and 25 feet wide.
Bridge at Broadway, across improved channel.	104	26	Double draw, road bridge, iron; opened to traffic January 1, 1895.
Hudson River Railroad Bridge, at mouth of Spuyten Duyvil Creek.	50	6.9	Single draw, wooden trestle, iron drawspan; will shortly be replaced by iron truss bridge with double drawspan.

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The following resolution, governing the closing of the bridges across the Harlem River at Madison and Third avenues at times when the land transportation over the bridges between the two shores was greatest, was adopted by the department of public parks, New York City, November 30, 1892:

Resolved, That from and after the 20th day of December, 1892, the draws of the bridges across the Harlem River at Madison and Third avenues shall not be opened or operated between the hours of 6 and 10 o'clock in the forenoon, and between 4 and 7 o'clock in the afternoon, except when otherwise ordered. This regulation shall not apply to the boats of the fire department, nor to the regular transportation boats of the New York and Northern Railway Company.

The regulations for the opening and operating of the draws in the bridges over the Harlem River, required in the river and harbor act of September 19, 1890, to be prescribed by the Secretary of War, will be prepared in time to be put in force whenever the bridges undergoing reconstruction have been completed in accordance with the notices given by the Secretary of War to the parties owning or controlling the said bridges.

BRIDGES AFFECTED BY STATE ACTS OR BY NOTICES SERVED BY THE SECRETARY OF WAR.

1. Bridge at First avenue, New York City.—An act of the legislature of the State of New York to provide for the construction of a bridge across the Harlem River from First avenue to Willis avenue was approved by the governor on March 21, 1894.

Plans for the construction of this bridge, conforming to the general provisions of the State act of 1879, as to height of lower chord and length of spans, prepared by the department of public parks of New York City, received the approval of the Secretary of War on January 11, 1895, but the work of construction has not yet been begun.

2. Bridges at Third and Fourth avenues.—The city of New York, owning or controlling the bridge at Third avenue, and the New York Central and Hudson River Railroad Company, owning or controlling the bridges at Fourth avenue, were notified by the Secretary of War, July 2, 1890, to modify these bridges in accordance with the recommendations of the Board of Engineers, convened May 7, 1890, to consider, as stated in the Annual Report for 1890, the matter of bridges across the Harlem River at Third and Fourth avenues, New York City. These notices required that the modifications called for should be completed by January 1, 1892.

The legislature of the State of New York, by act approved April 5, 1892, authorized and required an increased elevation of the Fourth Avenue Bridge, and provided for all changes in any avenues, streets, and railroads that may be necessary by reason of such increased elevation. A commission to carry out the provisions of this act was appointed by the mayor of New York City April 25, 1892. This act enabled the railroad company to reconstruct the bridge in conformity with the requirements of the notice of the Secretary of War, which in the absence of the necessary legislative action the company had not theretofore been able to carry out. Plans for the new bridge received the approval of the Secretary of War August 5, 1892.

In order that the traffic across the river may not be suspended while the permanent bridge is in process of construction, the railroad company applied to the Secretary of War for authority to build a temporary bridge, provided with a 60-foot draw, and situated 160 feet to the northward of the old bridge. This application was granted May 27, 1892. The railroad company began the work of modification in September,

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1892, and at the close of the fiscal year the old bridge had been removed and the traffic of the road diverted to the temporary bridge. The masonry of the north abutment and of the pivot pier of the new bridge was completed, the foundations of the north and south rest piers were in place, and work was in progress on the erection of the ironwork of the drawspan, and on the viaduct connecting with the bridge on the north and south sides of the river.

An act to provide for the reconstruction of the Third Avenue Bridge was approved by the governor of the State of New York May 2, 1892, and plans for the construction of the new bridge, prepared by the department of public works of New York City, received the approval of the Secretary of War March 24, 1893.

The work of modification began in November, 1893, and at the close of the year the old bridge had been removed and the traffic across the river had been diverted to the temporary bridge. The masonry of the pivot pier and of the south rest pier of the new bridge was completed, and work was in progress on the foundation of the north rest pier.

3. Macomb Dam Bridge.—The State act of April 29, 1890, authorizing the department of public parks of New York City to reconstruct the Macomb Dam Bridge at Seventh avenue was amended by a bill which became a law without the signature of the governor, January 31, 1895. The amendment provides that the awards for property taken shall not be paid out of the $1,250,000 appropriated for the bridge. The plans for the construction of this bridge were approved by the Secretary of War September 7, 1891.

Work on the construction was begun in June, 1892, and the bridge was completed in accordance with the approved plans and opened to traffic on May 1, 1895.

The temporary bridge, located about 220 feet to the northward of the new bridge and built for use during the construction of the latter under plans approved by the Secretary of War July 5, 1892, has been closed to traffic across the river, and will shortly be removed.

4. Bridge at Broadway crossing.—An act of the legislature of the State of New York to provide for the construction of a bridge across the Harlem Ship Canal, locally so called, on the line of Kingsbridge road, or Broadway extended, was approved by the governor April 5, 1892. Plans for the construction of this bridge, conforming to the general provisions of the State act of 1879, as to height of lower chord and length of spans prepared by the department of public works of New York City, received the approval of the Secretary of War February 11, 1893. Work on the construction was begun in June, 1893, and the bridge completed in accordance with the approved plans, and opened to traffic on January 1, 1895.

5. Bridge at mouth of Spuyten Duyvil Creek.—Plans for the reconstruction of the old railroad bridge at this site were submitted to this office by the New York Central and Hudson River Railroad Company May 31, 1894, for transmittal to the Secretary of War. These plans, which received the approval of the Secretary of War August 28, 1894, provide for the reconstruction of the bridge with a clear waterway of 105 feet in each draw opening, and with the lower chord of bridge placed at the height of 4½ feet, approximately, above mean high water.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

At the beginning of the year a contract was in force with the Morris & Cumings Dredging Company, dated September 8, 1893.

The river and harbor act, approved August 17, 1894, appropriated $125,000 for continuing the improvement, and a project for the expend-

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ture of this appropriation, together with available balances, was approved by the Chief of Engineers on August 30, 1894, the work to be done partly by contract and partly by hired labor. Sealed proposals for executing the work to be done by contract were invited September 13, 1894, and, with the approval of the Chief of Engineers, contract was made with Rittenhouse R. Moore, the lowest responsible bidder, November 20, 1894.

The contract with the Morris & Cumings Dredging Company, dated September 8, 1893, provides for the removal by dredging of 258,000 cubic yards, more or less, of mud, earth, and broken stone from the Harlem River, Spuyten Duyvil Creek, and from the remains of the dams inclosing the rock cut through Dyckman Meadow; for the removal of 5,000 cubic yards of ledge rock under water in the northeast end of the cut; and for the construction of about 650 linear feet of crib work and 475 linear feet of pile work revetment for protecting the sides of the section of cut to be excavated.

The contract with Rittenhouse R. Moore, dated November 20, 1894, provides for the removal by dredging of 360,000 cubic yards, more or less, of material from the Harlem River and Spuyten Duyvil Creek, and for the construction of about 500 linear feet of pile revetment for protecting the south side of the cut through Dyckman Meadow at its easterly end.

The work contemplated to be done by hired labor, using Government plant, in accordance with the project approved by the Chief of Engineers on August 30, 1894, comprises the removal of Candle Factory Reef, off the foot of East One hundred and twenty-second street, and other rocky obstructions in the lower Harlem River.

The contract with the Morris & Cumings Dredging Company, dated September 8, 1893, expired December 3, 1894, and was extended by the Chief of Engineers on application of the contractors to June 3, 1895, and again to September 3, 1895.

At the beginning of the fiscal year operations under the Morris & Cumings contract were suspended, to allow certain work on the new bridge under construction by the city of New York, at Broadway crossing, to proceed without interference by the operations under this contract. Work was resumed on August 4, 1894, and continued to October 13, 1894, when the contractors' plant was again withdrawn, as all the work to be done on the Spuyten Duyvil Creek section of the work was completed, and the channel excavation in the Harlem River had advanced as close to the temporary bridge at Broadway as was deemed prudent to dredge without danger to this structure, and the work yet remaining to be done under the contract could not well be undertaken before the permanent drawbridge was completed and the temporary bridge to the eastward of it removed.

The new bridge was finally completed on January 1, 1895, and dredging under the contract was resumed on January 28, 1895, and continued to February 7, 1895, when the river froze over, causing a further suspension of work. Operations were again resumed on March 28, 1895, and all the work under the contract practically completed at the close of the fiscal year.

Work under the contract with Rittenhouse R. Moore, dated November 20, 1894, was begun on April 1, 1895, and is still in progress.

The work of removing rocky obstructions in the lower Harlem River, by hired labor, was prosecuted throughout the fiscal year without prolonged interruptions by unfavorable weather or other causes.

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During the fiscal year the following work was done under the foregoing contracts, and by hired labor using Government plant:

DREDGING AND ROCK EXCAVATION.

[Under contract dated September 15, 1893.]

	Contract quantity.	Removed during fiscal year.	Removed prior to June 30, 1894.	Total removed under contract
Dredging:	*Cu. yds.*	*Cu. yds.*	*Cu. yds.*	*Cu. yds.*
From Spuyten Duyvil Creek and meadow west of west dam	40,000	1,781	36,413	38,194
From east and west dams and from canal prism between the two dams	60,000	16,186	46,323	62,509
From meadow east of east dam and in Harlem River	150,000	84,588	62,619	147,207
From shoals at Morris Dock and at High Bridge	8,000	.....	10,165	10,165
Rock excavation:				
Ledge in northeast corner of Dyckman Cut	5,000	174	4,380	4,554

[Under contract dated November 20, 1894.]

	Contract quantity.	Removed during fiscal year.	Remaining to be removed
Dredging:	*Cu. yds.*	*Cu. yds.*	*Cu. yds.*
From meadow and creek bed, between the west end of Dyckman Cut and the Hudson River	150,000	102,844	47,156
From meadow at east end of Dyckman Cut and from Harlem River between Broadway and High Bridge	175,000	7,182	167,818
From shoals at Morris Dock and High Bridge and from shoal between Macomb Dam Bridge and dock of elevated railroad at One hundred and fifty-eighth street	35,000	8,208	26,792

Timber revetments.—Under the contract dated September 8, 1893, 384 linear feet of crib-work revetment was built on the north side of Dyckman Cut and 200 linear feet of pile-work revetment on the south side, all east of Broadway.

The revetments built during the year are the eastward continuation of the timber revetments built between the rock cut and the Harlem River before the east dam was removed, and with them form permanent margins to the sides of the Dyckman Cut at its easterly end.

Removal of rocky obstructions in the lower Harlem River, by hired labor.—The work of removing Candle Factory Reef off the foot of East One hundred and twenty-second street, which was in progress at the end of the last fiscal year, was completed to the required depth of 15 feet at mean low water on February 7, 1895. The work of drilling and blasting was done by hired labor and use of the drill scow *Hudson*, and the broken stone removed partly by chartered dredge and partly by the Government dredge *Alpha*.

The reef is a rocky ledge projecting into the channel from the west bank of the river at the foot of East One hundred and twenty-second street. Before the beginning of operations for its removal the reef had an extreme length of 250 feet at the bulkhead line, extended out from it a distance of 100 feet at its widest part, and covered an area of about 20,000 square feet within the 15-foot contour. The least depth on the reef was 1.7 feet at mean low water, and as the highest point was close to the edge of the channel it formed a dangerous obstruction to the navigation of this section of the river. The main body of the reef consists of gneiss, nearly vertically stratified, the cavities between the ridges of solid rock being filled in with an aggregation of sand,

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gravel, and bowlders of various sizes, forming a compact mass from 2 to 3 feet thick in places.

Operations for the removal of the reef were first begun on September 11, 1893, and at the close of the last fiscal year 1,300 cubic yards of rock had been removed from it and a depth of 10 feet at mean low water had been obtained. The work was continued during the year up to February 7, 1895, when, as stated above, the required depth of 15 feet at mean low water was secured over the site of the original reef. In the operations for the removal of the reef a total of 904 holes were drilled, all extending to below the projected depth of 15 feet at mean low water, and 5,016 pounds of forcite was expended in breaking the rock. Most of the broken stone was dredged up by chartered dredge, which was employed a total of 86½ working days, and the remainder was removed by the Government dredge *Alpha*, working a total of 12 days. The total amount of material removed was 5,550 cubic yards, equivalent to about 11,000 tons, at a cost of $2.14 per ton, divided as follows: Labor, drilling, and blasting, 87 cents; cost of explosive, coal, and other material, 22 cents, and dredging and towing to place of deposit, $1.05.

Owing to the loose material covering portions of the ledge and the varying character of the rock itself, which consists of nearly pure quartz in some parts and of a disintegrated mass of mica and feldspar in others, much difficulty was encountered in drilling and charging the holes, which would fill up with gravel and small stone as soon as the drill was withdrawn and had to be subsequently cleared by water jet or suction or by reentering the drill repeatedly. The close proximity of buildings on the neighboring river banks also necessitated the employment of comparatively small charges of explosive, a further disadvantage to breaking up the rock economically. Considerable difficulty was also encountered in dredging up the broken stone, as the interstices between the larger fragments of stone upheaved by the blasts were rapidly filled in with the smaller loose material moved along by the swift current which ran over the reef at certain stages of the tide. thus forming a compact mass, which the teeth of the grapple or dipper could hardly penetrate. The item for dredging therefore forms a large percentage—nearly one-half—of the total cost of the work.

After the completion of the work on Candle Factory Reef the shoal to the southward of it, which consisted mainly of a deposit of gravel and bowlders of various sizes overlying the southerly extension of the reef proper, was also removed to the required depth of 15 feet at mean low water by the joint operations of the dregе *Alpha* and drill scow *Hudson*. In these latter operations 2,100 cubic yards of material were removed. By the removal of these obstructions the effective channel width of this section of the river was increased by nearly 100 feet.

On March 29, 1895, work was begun on the removal of the shoal south of Randall Island Dock. This shoal, which projects into the channel from the east bank of the river nearly opposite the site of Candle Factory Reef, also consists of an aggregation of gravel and bowlders overlying ledge rock, the higher portions of which rise to above the minus 15-foot plane in places, many of the bowlders being too large to be raised without first drilling and blasting them. At the close of the fiscal year 6,941 cubic yards of material, mostly bowlders and broken stone, had been removed, whereby the channel width on this side of the river was further increased by an additional 100 feet.

As the result of the year's work the channel in the Spuyten Duyvil Creek section of the improvement, which at the beginning of the year was from 140 to 150 feet wide and 9 feet deep at mean low water, was

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straightened by excavating a cut 12 feet deep at mean low water and about 140 feet wide through the point of meadow south of Johnson's Foundry, and generally deepened to a depth of 12 feet at mean low water from the Hudson River to the west end of Dyckman Cut, so that vessels drawing 12 feet can now ascend the improved channel at low water from the Hudson River to the new bridge at Broadway. The small amount of ledge rock remaining in the northeast end of Dyckman Cut at the beginning of the year was broken up and mostly removed, thus practically completing the rock cut to the required depth of 18 feet at mean low water. The remains of the dam at the east end of the cut were removed to a deph of 18 feet, mean low water, and the section of meadow lying directly east of the east dam was excavated to a depth of from 12 to 15 feet, mean low water, to a connection with the 9-foot channel dredged under former contracts in the Harlem River, thus removing the last barrier to navigable communication between the Hudson and Harlem rivers.

In the Harlem River the improved channel is 150 to 180 feet wide and 9 feet deep at mean low water from Broadway to a point 600 yards north of Morris Dock; from this point south to Macomb Dam Bridge at One hundred and fifty-fifth street the available channel is 160 feet wide and 10 feet deep at mean low water, and thence 15 feet and over can be carried to Wards Island, East River. By the removal of Candle Factory Reef and the shoal on the opposite side of the river south of Randall Island Dock the available channel width on this section of the river was increased from an original width of 100 feet to a present width of 300 feet, thus greatly relieving the crowded navigation of this reach of the stream.

The draft of vessels passing through the improved channel from the Hudson to the East River at low water is at present therefore limited to 9 feet; but by the completion of the work already under contract a 12-foot depth will be secured from river to river, in a channel with a width nowhere less than 150 feet.

The amount expended during the fiscal year ending June 30, 1895, inclusive of outstanding liabilities, was $119,375.69.

This improvement can not be well or economically conducted except under large appropriations. The amount that can be profitably expended during the fiscal year ending June 30, 1897, is $500,000.

A full statement of the commerce likely to be benefited by the improvement is subjoined.

Mr. A. Doerflinger, assistant engineer, has been in local charge of this improvement during the year. He has remained constantly upon the work and has discharged his duties with his accustomed fidelity and efficiency.

Harlem River is in the collection district of New York. The nearest light-house is on Blackwells Island.

AMOUNTS APPROPRIATED.

Allotment June 23, 1874, from appropriations for East and Harlem rivers.	$11,000.00
Act of—	
March 13, 1875	10,000.00
June 18, 1878	300,000.00
March 3, 1879	100,000.00
August 11, 1888	70,000.00
September 19, 1890	250,000.00
July 13, 1892	175,000.00
August 17, 1894	125,000.00
Total	1,041,000.00
Amount expended to June 30, 1895, inclusive of outstanding liabilities.	946,133.05

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Money statement.

July 1, 1894, balance unexpended		$89,242.64
Amount appropriated by act of August 17, 1894		125,000.00
		214,242.64
June 30, 1895 amount expended during fiscal year		89,409.56
		124,833.08
July 1, 1895, outstanding liabilities	$29,966.13	
July 1, 1895, amount covered by uncompleted contracts	56,439.39	
		86,405.52
July 1, 1805, balance available		38,427.56
Amount (estimated) required for completion of existing project		1,680,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		500,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for improving Harlem River, New York, received in response to advertisement dated September 13, 1894, and opened October 18, 1894, by Second Lieut. Robert McGregor, Corps of Engineers.

Material, etc.	(1) Morris & Cummings Dredging Co.		(2) W. H. Beard Dredging Co.	
	Per unit.	Amount.	Per unit.	Amount.
Dredging from Spuyten Duyvil Creek and Harlem River, 325,000 cubic yards of material, cubic yard	$0.16¾	$53,950.00	$0.18	$58,500
Dredging from shoals at Morris Dock, High Bridge, and McComb Dam Bridge, 35,000 cubic yards of material, cubic yard	.27	9,450.00	.31	10,850
Pile revetment:				
Pile driving, 22,000 linear feet, linear foot	.14	3,080.00	.18	3,960
Round timber, 23,000 linear feet, do	.06½	1,552.50	.10	2,300
Square timber, 38,000 feet B. M., M. feet B. M.	44.00	1,672.00	49.00	1,862
Tie-rods, driftbolts, screw bolts, etc., 27,000 pounds, pound	.04½	1,215.00	.06½	1,755
Stone filling, furnished by contractor, 6,000 cubic yards, cubic yard	.54	3,240.00	.70	4,200
Stone filling, Government stone used, 6,000 cubic yards, cubic yard	.54	3,240.00	.70	4,200
Total	.....	74,159.50	.....	83,427

Material, etc.	(3) J. H. Fenner.		(4) Rittenhouse R. Moore.		(5) P. Sanford Ross.	
	Per unit.	Amount.	Per unit.	Amount.	Per unit.	Amount.
Dredging from Spuyten Duyvil Creek and Harlem River, 325,000 cubic yards of material, cubic yard	$0.19½	$63,375	$0.18	$58,500	$0.18½	$60,125
Dredging from shoals at Morris Dock, High Bridge, and McComb Dam Bridge, 35,000 cubic yards of material, cubic yards	22½	7,875	.20	7,000	.33	11,550
Pile revetment:						
Pile driving, 22,000 linear feet, linear foot	.10	2,200	.07	1,540	.07	1,540
Round timber, 23,000 linear feet, do	.10	2,300	.06	1,380	.09	2,070
Square timber, 38,000 feet B. M., M. feet B. M.	31.00	1,178	30.00	1,140	33.00	1,254
Tie-rods, driftbolts, screw bolts, etc., 27,000 pounds, pound	.03	810	.03	810	.03	810
Stone filling, furnished by contractor, 6,000 cubic yards, cubic yard	.50	3,000	.50	3,000	.55	3,300
Stone filling, Government stone used, 6,000 cubic yards, cubic yard	.50	3,000	.40	2,400	.55	3,300
Total	.....	80,738	.....	{ 73,370½ *72,770½	.....	80,649

* Using Government stone; lowest bid.

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COMMERCIAL STATISTICS.

The commercial statistics for the fiscal year ending June 30, 1893, have remained practically unchanged, and are therefore herein repeated.

As there is no navigable communication between the Harlem River and Spuyten Duyvil Creek, the present navigation of the Harlem River is practically confined to that part of the stream between its junction with the East River and Satterlee's Dock, at foot of Two hundred and twentieth street, a distance of about 8 miles.

Spuyten Duyvil Creek is navigable from its junction with the Hudson River to Kingsbridge, a distance of 1¼ miles.

The actual commerce of the Harlem River and Spuyten Duyvil Creek for the fiscal years ending June 30, 1890, and June 30, 1893, was as follows:

Items.	1890.	1893.	
	Tons.	*Tons.*	
General merchandise	1,379,334	3,232,052	$159,635,435
Grain flour, feed, etc	400,987	596,306	15,147,478
Lumber and timber	346,858	451,702	7,462,403
Building material	642,922	602,217	2,791,109
Fuel	508,365	878,234	4,573,836
Ice	112,000	149,865	539,460
Total	3,390,466	5,910,376	190,149,712

The total tonnage for the year 1893 shows an increase over that of 1890 of 2,519,910 tons, or about 75 per cent, during the three years. This increase is largely due to the increase in the amount of freight handled at the docks of the New York, New Haven and Hartford Railroad Company, directly below Second Avenue Bridge, where alone 3,243,850 tons was received and shipped, as compared to 1,407,882 tons received and shipped in 1890. At the docks of the New York and Northern Railway Company, near High Bridge, 166,066 tons was received and shipped. Of the balance of tonnage, 2,475,275 tons was distributed among the various docks on the Harlem River between its junction with the East River and Satterlee's Dock at Two hundred and twentieth street, and 25,185 tons at various points on Spuyten Duyvil Creek.

As near as can be determined the traffic on the river was carried by the following vessels:

Canal boats, barges, and railroad-car floats	20,361
Sailing vessels, schooners, lighters, etc	4,476
Steamers and tugs, exclusive of naphtha launches	15,241
Total	40,078

A large proportion of the freight handled at the railroad docks is carried in and out of the Harlem on railroad-car floats and transfer boats connecting the railroads of New Jersey and Pennsylvania, terminating at Weehawken, Hoboken, and Jersey City, with those of New England, while the general commerce of the river is carried on mainly in barges and canal boats in tow of steam tugs, and in schooners and the smaller class of sailing vessels.

CHAP. 147.—AN ACT to provide for the construction of a bridge over the Harlem River, in the city of New York.

[Became a law March 21, 1894, with the approval of the governor. Passed, three-fifths being present.]

The people of the State of New York, represented in senate and assembly, do enact as follows:

SECTION 1. The commissioner of public works of the city of New York is hereby authorized to erect and construct of stone, iron, or steel, or of one or more of these materials, a suitable bridge and approaches thereto, with the necessary abutments and arches over adjacent streets and avenues, for the passage of persons, animals, vehicles, and traffic across the Harlem River, in said city, from and at a point commencing at the northeasterly corner of One hundred and twenty-fifth street and the First avenue, and running thence northeasterly, or nearly so, to and across the said Harlem River, to and along Willis avenue, to and at One hundred and thirty-fourth street, or at such points on said streets and avenues as the said commissioner shall ascertain and determine to be most practicable, and to make such changes in the grade lines of the streets or avenues approaching said bridge as may be necessary to carry out the purpose of this act and for the proper construction of the improvements hereby

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authorized. Said bridge shall be completed within eight years from the passage of this act, and shall in its width for passage be not less than sixty feet, and the grade thereof shall be at an elevation of not less than twenty-four feet above mean high-water mark of said river, and not less than sixteen feet and six inches in the clear over the present grade of the tracks of any steam railroad in the line of said bridge and its approaches at the point where the said bridge when constructed will pass over said tracks, and shall be otherwise constructed in conformity with the general provisions of law contained in section six hundred and seventy-six, chapter thirteen of chapter four hundred and ten of the laws of eighteen hundred and eighty-two, regulating the construction of bridges over the Harlem River and Spuyten Duyvil Creek, except that, for the purpose of carrying out the provisions of this act, the power and authority conferred upon and vested in the department of public parks in said section six hundred and seventy-six, chapter thirteen of chapter four hundred and ten of the laws of eighteen hundred and eighty two, or any act or acts amendatory thereof, are hereby transferred and temporarily vested in the commissioner of public works. Said bridge shall always be free for the passage of persons, animals, vehicles, and traffic, and when completed shall be turned over by the commissioner of public works to the department of public parks, which shall thereafter keep and maintain the same in good order and repair; provided, however, that nothing shall be done under this act until the plans and specifications for the said bridge and approaches thereto, with the necessary abutments and arches as aforesaid, as well as the proposed changes hereby authorized in the grade lines of the streets and avenues approaching the said bridge, shall have been submitted by the commissioner of public works to and approved by the board of estimate and apportionment of said city, which submission and approval, however, shall be within four years after the passage of this act.

SEC. 2. The said commissioner of public works shall, upon such approval by the board of estimate and apportionment, proceed to construct the said bridge and approaches thereto with the necessary abutments and arches as aforesaid. The work of constructing the said bridge and approaches thereto with the necessary abutments and arches as aforesaid, and the furnishing of all the material and labor necessary therefor, shall be done by contract made at public letting to the lowest bidder pursuant to the general provisions of law and ordinance regulating the letting of contracts in said city.

SEC. 3. The expense of making all necessary surveys, preparing the plans and specifications, and of constructing the said bridge and approaches thereto with the necessary abutments and arches as aforesaid, shall not exceed $2,000,000, and such further sum for paying awards for damages caused by reason of the change of grade of streets or avenues approaching the same, authorized by this act, as may be awarded by the board of assessors of the said city, whose duty it shall be to estimate the damage which each owner of land fronting on such street or avenue will sustain by reason of such change to such land, or to any improvements thereon, and make a just and equitable award to the amount of such damage to the owner or owners of such lands or tenements fronting on such street or avenue, and opposite thereto, and affected by such change of grade. The comptroller of said city shall, from time to time, when directed by the board of estimate and apportionment, prepare and issue bonds of said city bearing interest at not more than 4 per cent per annum, and redeemable from time to time, but not less than twenty years after the date thereof, for the purpose of defraying the expense of making all necessary surveys, preparing plans and specifications, and of constructing the said bridge and approaches thereto, with the necessary abutments and arches as aforesaid, and for paying the awards which may be made for damages by reason of any change of grade as aforesaid. Such bonds shall not be sold for less than the par value thereof, and the moneys received from the sale of the said bonds shall be deposited in the treasury of the said city, and shall be drawn and paid by the comptroller of the said city for the several objects and purposes provided in this act, upon vouchers in a form to be prescribed by the said comptroller.

SEC. 4. With the consent and approval of the board of estimate and apportionment first had and obtained the commissioner of public works, for and in behalf of the mayor, aldermen and commonalty of the city of New York, is hereby authorized to acquire title in fee to any land which he may deem necessary for the purpose of the construction of the said bridge and approaches, with the necessary abutments or arches as aforesaid, and to acquire any right or easement which it may be necessary to take for the purpose of constructing that portion of the approach to said bridge between Harlem River and One hundred and thirty-second street, which said portion of said approach shall be a viaduct built of steel or iron, and to that end the said commissioner may make application to the supreme court in the first judicial district for the appointment of commissioners of estimates, specifying in such application the lands sought to be acquired for the purpose aforesaid. The provisions of law relating to the taking of private property for public streets or places in the said

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city are hereby made applicable as far as may be necessary to the acquiring of the said land as aforesaid. The amount or amounts awarded for the said land and the expense of the proceedings hereby authorized for the acquiring of the same shall form part of and be included within the expense of constructing the said bridge and approaches thereto, with the necessary abutments and arches authorized by the third section of this act.

SEC. 5. Nothing in this act contained shall prevent the commissioner of public works at any time within the periods of time mentioned in section 1 of this act from make the preliminary surveys, plans, and specifications as therein provided, and present the same for approval to the board of estimate and apportionment, and after such approval the said commissioner of public works may immediately proceed to construct said bridge as provided by this act; provided the said board of estimate and apportionment shall deem it expedient and for the public interest that said bridge shall be sooner constructed and opened as a public thoroughfare for public convenience and travel.

SEC. 6. This act shall take effect immediately.

E 6.

IMPROVEMENT OF EAST RIVER AND HELL GATE, NEW YORK.

The East River is the name given to the narrow tidal strait which connects New York Harbor with Long Island Sound. It forms an entrance to the harbor of New York secondary in importance only to the main entrance by way of Sandy Hook and the Narrows, since the heavy coasting trade carried on by New York and the New England States and the British American Provinces passes almost exclusively through it.

The population now gathered around the waters of New York Harbor numbers 3,000,000 or more, and should the present rate of increase, as shown by the census returns, be maintained for half a century longer, the population would then be about 8,000,000.

New York City can grow only in one direction, and that is into Westchester County, on the north, since on all other sides it is surrounded by water; and the development of the water fronts along the Hudson and East rivers must therefore be certain and rapid. With this development the importance of the East River entrance to New York Harbor will increase enormously; and it seems not unreasonable to predict that within the next fifty years every foot of shore line on both sides of the East River within 15 miles of Harlem River and Hell Gate will be occupied with wharves filled with shipping, engaged not only in the coasting and transatlantic trade, but in the commerce of the world.

The East River is crooked and narrow in places, and much obstructed by rocks and affected by violent currents.

The worst of these obstructions was originally that known as Hell Gate, lying at the mouth of the Harlem River, between Blackwells and Ward islands, about opposite Ninety-sixth street, New York. Here the river turns at right angles around Hallets Point, divides into several channels, and runs with a velocity varying at different stages of the tide from 3 to 10 miles an hour over or around Hallets Point, Negro Point, Ways Reef, Shell Drake, Pot Rock, Frying Pan, Heel Tap, Holmes Rock, Hog Back, Flood Rock, Hen and Chickens, Gridiron, the Negro Heads, Mill Rocks, Rhinelander Reef, and Bread and Cheese.

On account of the violence and irregularities of the currents and the crowded condition of this passage, wrecks at Hell Gate were numerous prior to 1867. At that time some of these rocks projected above

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the water level, while the least depth over others at mean low water varied from nothing to 20 feet. In obedience to the provisions of the act approved June 23, 1866, an examination was made of Hell Gate by the local engineer with a view of its improvement for purposes of navigation, and three separate projects were submitted January 21, 1867, for the improvement, affording channels of 26 and 24 feet in depth at mean low water. The project which was adopted in 1867 (see Annual Report of the Chief of Engineers for 1868, p. 741) provided for the removal of the rocks and reefs that lie directly in the channel to a depth of 26 feet at mean low water, and for the building of sea walls and dikes upon others that lie near the edge of the channel, in order to guide the currents in such a way that vessels might pass the reefs in safety. The cost of the project was estimated at $8,692,645.15. The removal of Hallets Point was begun in 1869 and the final blast occurred September 24, 1876. A new estimate was made January 3, 1870, "based upon the process of tunneling the larger reefs, such as Hallets Point and the Middle Reef, and removing the smaller reefs by drilling from the surface of the water," and the cost was placed at $4,689,820.

The estimate was again revised in 1874 to include the removal of Diamond and Coenties reefs (see Annual Report of the Chief of Engineers for 1874, Part II, p. 164), and the total cost fixed at $5,139,120. It provides for the removal at Hell Gate to a depth of 26 feet, mean low water, of the reefs at Hallets Point, Ways Reef, Shell Drake, Pot Rock, Frying Pan, Heel Tap, Negro Point, and Flood Rock, including the Gridiron, Hen and Chickens, and Negro Heads, and the construction of a dike to connect the Mill Rocks and sea walls upon Hog Back and Holmes Rock; and, in other parts of the East River, for the removal of Diamond Reef and North Brothers Island Reef to a depth of 26 feet, Coenties Reef to a depth of 25½ feet, and the small rocks known as Scaly Rock, Blackwells Rock, and the rock off Woolsey's bath house.

The work of mining Flood Rock began in June, 1875.

In 1880 part of the débris arising from the excavation of the subaqueous galleries in Flood Rock was deposited in the unused channel between Great Mill and Little Mill rocks, and a dike, with its crown rising above mean high water, was formed as a training wall for the currents through the Gate. This dike was utilized later as a place for the storage of public material and the berthing of plant used upon the improvement.

In 1882 a protection wall was built by the city of New York upon the reefs, locally known as "Bread and Cheese," which projects into the Gate from the eastern end of Blackwells Island.

The great and final blast for the demolition of Flood Rock was fired October 10, 1885, since which date large dredges have been employed to raise the stone broken by the explosion.

The project for the improvement of East River was enlarged in 1884 to include the removal of Pilgrim Rock, off Nineteenth street, to 24 feet mean low water, and again in 1889 to include removal of the reef off Diamond Reef, Ferry Reef, off Thirty-fourth street, and Charlotte Rock, northwest of entrance to Newtown Creek, to 26 feet mean low water; work to be done by hired labor with drill scow.

A steam-drill scow fitted with a movable iron dome working within a central well was put in operation in the winter of 1870–71 for the removal of shoal subaqueous reefs. Its results have been most satisfactory, as by its use rock swept by the swift currents of the East River are easily and economically drilled and blasted.

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The stone broken by the blasts are sometimes removed by appliances attached to the scow, but usually by use of the Government dredges employed at Hell Gate.

At the close of the fiscal year ending June 30, 1894, the following parts of this project had been executed: Hallets Point, covering 3 acres; Ways Reef, Shell Drake, Diamond Reef, North Brothers Island Reef, Coenties Reef, reef off Diamond Reef, Baretto Reef, and Scaly Rock, had been removed to the depth contemplated in the project; Pilgrim Rock and Ferry Reef had been reduced to a least depth of 24 feet; Heel Tap had been broken to 26 feet and dredged to 20.5 feet; and the least depths on Frying Pan and Pot Rock were 18 feet and 22.8 feet at mean low water, respectively; Flood Rock and connecting reefs, covering 9 acres, had been broken to 30 feet and 204,015 tons of débris had been removed. The least depth over Flood Rock, Hen and Chickens, and Gridiron was 20 feet at mean low water and that in the channel between Flood Rock and the Mill Rocks was 18 feet, mean low water. Shell Reef, off Ninth street, had been reduced to 18 feet, mean low water, except at a few points. The reef off Sunken Meadow, which originally had only 11 feet over it, had been lowered to 14 feet, mean low water, over the main reef, and to 18 feet, mean low water, on the southern half.

Hell Gate, as has been said, is the worst obstruction found in the East River; but there are rocks and reefs in other parts of this crowded waterway which are constant sources of danger to passing vessels, which have often been complained of and which ought to be removed.

The first to be mentioned is the long line of reefs and isolated rocks in mid stream, extending 1½ miles southward and westward from the foot of Blackwells Island, which have always been troublesome to vessels beating up against the wind or crossing from one channel to the other, as the winds and tides often compel them to do, and which, with the continually increasing size of vessels and the increasing commerce of the river, are becoming still more dangerous. The Man-of-War Rock, marked by a spindle, opposite Thirty-eighth street, is a prominent part of this reef.

A second and still more serious obstruction to the navigation of the East River that is constantly complained of by mariners is Middle Ground, which is situated in mid-channel 1½ miles to the eastward of Hell Gate, near the southern entrance to Little Hell Gate, between Sunken Meadows and Lawrence Point, with a channel on either side of barely 350 feet width. A project for lowering this reef to the plane of 18 feet, mean low water, is in progress of execution.

The suit begun by private parties to dispossess the United States of its occupancy of the dike built by it between Great and Little Mill rocks, Hell Gate, was decided by the courts in May, 1889, in favor of the United States, but appeal has been taken by the complainant to a higher court. It is highly important that the United States retain possession of the dike, as the ground is very much needed for wharfage and for repair shops for the steam-drill scow and the dredges. The old machinery and worn-out plant and material stored for many years at Hallets Point have been sold at public auction, and the office for the local conduct of this improvement has been transferred to the dike.

The plant in active use on the improvement has been put in good repair during the year.

The Secretary of War established, March 9, 1892, harbor lines around Great and Little Mill rocks, Hell Gate, restricting the construction of piers and bulkheads to high-water line.

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BRIDGES AFFECTED BY CONGRESSIONAL OR STATE ACTS.

New York and Long Island Bridge Company's bridge at Blackwells Island.—Authorized by the act of Congress approved March 3, 1887. The original plans for this bridge, approved by the Secretary of War in October, 1887, were amended by act of Congress approved March 14, 1894, which provides that the lowest part of the superstructure, over the entire width of the waterway, shall not be less than 135 feet above mean high water of spring tides. Work is in progress on the foundation of the piers on both shores of Blackwells Island and on Ravenswood Shore, Long Island.

East River Bridge Company's bridge.—By State act March 9, 1892, this company was authorized to construct a bridge, at a height of 140 feet above mean high water at center and 120 feet at piers, between Broadway, Brooklyn, and Rivington street, New York City; also a second bridge, at a height of 135 feet at center and 120 at piers, from Bridge street, Brooklyn, to a junction in New York City with the first-mentioned bridge. The plans for these bridges were approved by the Secretary of War, February 16, 1893, under authority of section 3 of river and harbor act of July 13, 1892. No work of active construction is in progress.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

At the opening of the fiscal year no contract was in force and no operations were in progress with Government plant, as, on account of the exhaustion of funds, the plant was laid up December 28, 1893.

The river and harbor act of August 17, 1894, appropriated $75,000 for continuing improvement.

The project for the expenditure of this sum, providing for continuing work with Government plant on reef off Sunken Meadow, and for the repair of U. S. dredge *Hell Gate*, was approved by the Chief of Engineers, August 29, 1894.

The U. S. steam-drill scow *Gen. John Newton* resumed operations on reef off Sunken Meadow on October 4, 1894, and continued until February 7, 1895, at which date the ice in the river compelled a suspension of work. Work was again resumed May 1, and was in progress at the close of the year.

The following table shows the work done during the fiscal year, and the total to date, on the reef off Sunken Meadow:

	During fiscal year.	Total to date.
Number of times dome was lowered	47	117
Number of holes drilled	258	690
Total depth of holes drilled.....feet..	1,713.2	4,864.2
Actual time running drills.....hours..	229	582
Average depth of holes.....feet..	6.6	7
Number of drill-hole blasts fired	47	117
Pounds of explosive used (forcite No. 2)	13,093	35,916
Tons of broken stone raised by divers	221	461
Tons of broken stone raised by pump	198	329
Tons of broken stone raised by dredge	262	7,488
Total tons raised and dumped	681	8,278
Total cost of work	$20,400.00	$55,300.00
Cost per ton of rock removed (1,500 tons blasted not yet removed)	$30.00	$6.70

On October 31, 1894, two coal barges, and on May 12, 1895, one coal barge, collided with the drill scow while at work on the reef, and were sunk. The vessels, with their cargoes, were removed by the owners without expense to the United States.

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Advertisement and specifications for repair of dredge *Hell Gate* were issued November 16, and proposals opened December 29. With the approval of the Chief of Engineers a contract for the sum of $15,800 was entered into with Patrick Ward, the lowest bidder, on January 11, 1895, and the dredge was fully repaired and put in good working order by June 29, subject to a test trial of thirty days.

The obstruction opposed to navigation by the rocky reef off Sunken Meadow, where the steam drill scow *Gen. John Newton* is now employed, is very serious. It is 1,000 feet long and 450 feet wide, and lies directly in mid-channel, on the immediate approach to Hell Gate, with a navigable channel on either side which is barely 350 feet wide.

It is highly important to coastwise navigation that this reef should be lowered as early as practicable to the plane of 20 feet at mean low water, in furtherance of the contemplated project.

The amount that can be profitably expended in the removal of obstructions in East River and Hell Gate during the fiscal year ending June 30, 1897, is $200,000, to be applied to the removal of Flood Rock and of reef off Sunken Meadow and to the removal of rocky obstructions at such other points in the East River as the necessities of navigation demand, notably Charlotte Rock and unnamed rock off Twenty-sixth street, discovered in 1893.

This work is in the collection district of New York. The nearest port of entry is New York City. The nearest light is Blackwells Island Light. The nearest fort is Fort Columbus, Governors Island, New York Harbor.

AMOUNTS APPROPRIATED.

Act of—		Act of—	
July 25, 1868	$85,000.00	May 4, 1882	$50,000.00
April 10, 1869	178,300.00	August 2, 1882	200,000.00
July 11, 1870	250,000.00	July 5, 1884	360,000.00
March 3, 1871	250,000.00	August 5, 1886	112,500.00
June 10, 1872	225,000.00	August 11, 1888	250,000.00
March 3, 1873	225,000.00	September 19, 1890	200,000.00
June 23, 1874	225,000.00	July 13, 1892	150,000.00
March 3, 1875	250,000.00	August 17, 1894	75,000.00
August 14, 1876	250,000.00	Received from other sources	3,719.62
June 18, 1878	350,000.00		
March 3, 1879	250,000.00	Total	4,339,519.62
June 14, 1880	200,000.00		
March 3, 1881	200,000.00		

Deduct amount reverted to U. S. Treasury	$3,158.55	
Deduct amount allotted to Harlem River	11,000.00	
		14,158.55
		4,325,361.07
Amount expended to June 30, 1895, inclusive of outstanding liabilities		4,287,364.95

Money statement.

July 1, 1894, balance unexpended	$11,407.58
Amount appropriated by act of August 17, 1894	75,000.00
	86,407.58
June 30, 1895, amount expended during fiscal year	28,719.80
July 1, 1895, balance unexpended	57,687.78
July 1, 1895, outstanding liabilities	19,691.66
July 1, 1895, balance available	37,996.12
Amount (estimated) required for completion of existing project	813,840.67
Amount that can be profitably expended in fiscal year ending June 30, 1897	200,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

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Abstract of proposals for repairing U. S. engineer dredge Hell Gate, received in response to advertisement dated November 16, 1894, and opened December 29, 1894, by Lieut. Col. G. L. Gillespie, Corps of Engineers.

No.	Name of bidder.	Amount of bid for repairing the dredge.
1	James D. Leary	$21,667
2	Patrick White & Sons	20,925
3	Patrick Ward *	15,800
4	Hugh Ramsay	21,000
5	R. G. & J. S. Packard	27,450

* Lowest bid.

COMMERCIAL STATISTICS.

The commercial statistics for the fiscal year ending June 30, 1890, have remained practically unchanged and are therefore herein repeated.

The registered tonnage, exclusive of coastwise vessels and local steamers, so far as it can be ascertained, is 10,165,325 tons.

The commerce of the East River is so intimately connected with that belonging to New York Harbor proper that it is impossible to make a separate statement of it.

The following list of vessels, not inclusive of daily passenger and freight steamers, passing through Hell Gate for the fiscal year ending June 30, 1890, has been compiled from the maritime records at Whitestone, Long Island, kept by the New York Herald:

	Bound east.	Bound south.
Steamers	642	1,048
Ships	23	13
Barks	115	56
Brigs	80	61
Schooners	5,493	10,528
Tugs	680	682
Barges	2,612	2,862

E 7.

IMPROVEMENT OF NEWTOWN CREEK, NEW YORK.

Newtown Creek is a tidal stream, about 4 miles long, running through the eastern part of Brooklyn and emptying into the East River opposite Thirty-fourth street, New York. The range of tides is 4½ feet, approximately, but the bed of the creek has no natural slope.

In 1857 it had a depth of about 17 feet, which had decreased in 1880 to about 12½ feet at low water from its mouth up to the Vernon Avenue Bridge, a distance of 1,100 feet, its width for this distance being about 240 feet. Thence it gradually decreased in width and depth until at the head of navigation, where the Metropolitan avenue crosses it, there was a low-water depth of about 4 feet and a width of about 100 feet.

A survey of this creek, with a view of its improvement, was made in 1879 by the engineer officer then in charge, to comply with the act of March 3, 1879, and a report submitted January 31, 1880. The project provided for dredging a channel from the mouth of the creek to Vernon Avenue Bridge 200 feet wide and from 21 to 22 feet deep at low water, requiring the removal of 145,000 cubic yards of material, chiefly mud, the cost of which was estimated at $36,250.

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Work under this project was begun in 1880, but by the reason of increased cost of dredging the estimated cost was increased to $44,050.

Under the act of Congress passed August 2, 1882, another survey was made, and a report submitted December 26, 1883. (Annual Report Chief of Engineers, 1884, p. 765.)

The new project provided for carrying the improvement from the Vernon Avenue Bridge up to the head of navigation in both branches of the creek. The estimated cost of executing this project was $255,569.

The appropriations of 1884 and 1886 were applied in deepening the channel from the entrance to Vernon Avenue Bridge to 18 feet mean low water, and from Maspeth avenue eastward to the head of navigation 10 feet, mean low water. The amount appropriated up to and inclusive of act August 5, 1886, was $82,500, of which amount the sum of $50,750 has been applied from Vernon Avenue Bridge to the East River, and $31,750 from Covert Dock upstream to the head of navigation on both branches. These appropriations were made in small amounts and at wide intervals, and the work done by them gave only temporary relief. According to these methods the amounts applicable for improvement at the entrance were about sufficient to remove deposits which had been made during the interval, leaving no balance for increasing the depth beyond 20 feet. The improvement could not, for want of funds, be extended to benefit the central reach of the river above Vernon Avenue Bridge, and in the absence of secure bulkheads dredging in the upper branches was of little avail. It would have been better had appropriations been made in such a way that the improvement above Vernon Avenue Bridge could have been executed as an extension of the improvement below it. Then, as the improvement advanced upstream, the wharves along the banks would have been benefited progressively and in proportion to their importance.

A revised estimate for the improvement was made in 1889 (Annual Report Chief of Engineers, 1889, Part I, p. 778), after the results obtained by the survey of January, 1889, had been studied, and the cost was fixed at $170,586.

In preparing the new project for the improvement it was kept in mind that the draft of vessels going above Vernon Avenue Bridge, where the most important wharves are located, was limited by the then available depth of water, and that many vessels had to be lightered at the bar to facilitate entrance at high tide, while those going out had to complete their cargoes after they reached the East River. It was therefore thought best to provide for 21 feet from the entrance to Vernon Avenue Bridge, 18 feet to Central Oil Works, 15 feet to Queens County Oil Works, 12 feet to Nichols Chemical Works, and 10 feet to Metropolitan Avenue Bridge, on both branches.

The bed of the creek below Vernon Avenue Bridge is variable in character below the plane of 18 feet mean low water. Near the bar it is composed of sand, or sand and clay mixed; but as the bridge is approached it grows harder, like hardpan, and has large bowlders embedded in it. The creek has a very sluggish current, and where there are no bulkheads the deposits arising from the sewers and from the degradation of the soft and unstable banks cause obstructions to navigation, for which annual dredging is the only possible relief.

Above Vernon Avenue Bridge, extending even to Metropolitan avenue, the present head of navigation, the bed of the stream, near the plane of 10 feet below mean low water, is frequently found covered with bowlders, lying in groups, so large as to require resort to submarine blasting before removal can be effected by the usual dredging plant.

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This circumstance tends to increase the cost of improvement over original estimates.

The river and harbor act of September 19, 1890, appropriated $35,000 for continuing the improvement, which was applied throughout the main river, giving 21 feet at the entrance and declining to 10 feet at the head of navigation. In the "English Kills," a northern branch of the river skirting Laurel Hill, a channel was made 700 feet long, 100 feet wide, and 10 feet deep, mean low water. The contract was closed August 24, 1891.

The river and harbor act of July 13, 1892, appropriated $35,000 for continuing the improvement. The work provided for by this appropriation was let to contract, as stated in last Annual Report, and the project under it was completed and work suspended March 27, 1893.

The following table shows the location and characteristics of the several bridges crossing Newtown Creek:

Name and location of bridge.	Width of draw.	Height of bottom chord above mean high water.	Remarks.
	Feet.	*Feet.*	
Vernon Avenue Bridge.....	63	7.3	Road bridge; double draw; iron, on wooden pier; opens by hand power.
Blissville Bridge (Greenpoint avenue).	58	8.9	Road bridge; double draw; wood, on wooden pier; opens by hand power.
Penny Bridge (Meeker avenue).	65	9.7	Road bridge; double draw; iron, on stone pier; opens by hand power.
Grand Street Bridge.....	57	5.8	Iron on stone pier; single draw road bridge; opens by hand power.
Metropolitan Avenue Bridge (Metropolitan avenue and Grand street junction).	62	8.7	Road bridge; double draw; iron, on stone pier; opens by hand power.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

At the opening of the fiscal year no contract was in force.

The river and harbor act of August 17, 1894, appropriated $20,000 for continuing the improvement. The project for the expenditure of this appropriation was approved by the Chief of Engineers August 30, and on October 30, after advertisement according to law, a contract was entered into with Thomas Potter for removing material from the mouth to Central Oil Works, at 27 cents per cubic yard; and from Queens County Oil Works to Grand street, at 24 cents per cubic yard.

Work began under this contract December 17, 1894, and was completed April 15, 1895, during which time there had been removed the following quantities of material:

	Cubic yards.
From mouth of creek to Vernon Avenue Bridge	10,918
From Vernon Avenue Bridge to Central Oil Works	7,412
From Queens County Oil Works to Nichols Chemical Works	33,042
From Nichols Chemical Works to Maspeth avenue	12,802
From West Branch to Grand street	8,220

In addition to the above, 150 tons of bowlders, that were uncovered by the operations of the dredge, were drilled, blasted, and removed by hired labor, using the U. S. engineer drill scow *Hudson*.

At the close of the fiscal year, the 18-foot channel from the entrance to Vernon Avenue Bridge is 175 feet wide at the entrance and 150 feet wide at and near the bridge, with a 21-foot channel 40 feet wide in the center. The channel from Vernon Avenue Bridge to Central Oil Works

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is 80 feet wide and 16 feet deep, mean low water, with an 18-foot channel 40 feet wide through the center; from Central Oil Works to Queens County Oil Works, 100 feet wide and 14 feet deep; from Queens County Oil Works to Nichols Chemical Works, 100 feet wide and 12 feet deep; from Nichols Chemical Works to Maspeth avenue, 75 feet wide and 10 feet deep; from Maspeth avenue to Metropolitan avenue, on the East Branch, 100 feet wide and 10 feet deep; and on the West Branch, 50 feet wide and 10 feet deep. In the English Kills Branch the channel is 100 feet wide and 8 feet deep from Nichols Chemical Works to a point 700 feet to the eastward.

The estimate of $58,000, recommended for the fiscal year ending June 30, 1897, will, if appropriated, complete the project of 1883, and if the improvement is to be continued thereafter a new project and estimates will be required.

The first public hearing in the matter of the complaint against the Vernon Avenue Bridge was held July 13, 1893. After many postponements, granted at the request of the supervisors who expressed themselves anxious to replace the bridge by a tunnel, the last hearing was held November 20, and the final report to the Chief of Engineers was submitted December 14, 1893. In the report it was recommended that the supervisors of Kings and Queens counties, owning or controlling the bridges, be required to place and maintain the existing bridge in good repair, and to apply and maintain a modern motor attachment to the draws, pending action, not later than May 1, 1894, by the State legislature, expected to provide for the construction of either a tunnel or a high bridge under or over the site of the existing bridge. These recommendations were approved, and an appropriate notice conforming thereto was served upon the supervisors by direction of the Secretary of War December 22, 1893.

An enabling act for the construction of a tunnel at Vernon avenue crossing was passed by the State legislature in May, 1894, but was vetoed by the governor.

In view of the veto, the Secretary of War, before giving final judgment upon the matter of the bridge, directed that the parties in interest should have another and final hearing. The hearing was held Wednesday, June 20, after which final report was submitted recommending that the requirements contained in the original notice of the Secretary of War served upon the supervisors December 22, 1893, be carried out.

On the 30th of June, 1894, the Chief of Engineers, by direction of the Secretary of War, requested the supervisors of Kings and Queens counties, N. Y., by letter, to submit for approval of the Secretary of War, within thirty days, plans for reconstructing the existing bridge conformable to the requirements contained in the report of the local engineer dated June 25, 1894.

On the 25th of July the attorney of the board of supervisors asked for an extension of time for the submission of plans for the construction of a new bridge.

This request was granted by the Secretary of War August 10, with the proviso that pending the preparation of the plans the old bridge be supplied with an electric motor for maneuvering the draws.

A further extension was granted, subsequently, on the statement by the supervisors that a project was under consideration for the construction of a lift bridge in place of the ordinary swing bridge.

On April 29, 1895, plans for a lift bridge, and for a temporary bridge for the accommodation of land travel during construction of the lift

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bridge, were submitted by the supervisors and received the approval of the Secretary of War May 7, 1895.

There are so many interests involved in the reconstruction of this bridge that it was deemed best, so long as navigation did not suffer, to allow the supervisors liberal time for the selection of a suitable character of bridge and for the preparation of the necessary plans.

This work is in the collection district of New York. Nearest port of entry, New York City; nearest light-house, Blackwells Island; nearest fort, Fort Columbus.

AMOUNTS APPROPRIATED.

Application.	Date.	Amount.
Dredging below Vernon Avenue Bridge	June 14, 1880	$10,000
Do	Aug. 2, 1882	15,000
Part applied above Vernon Avenue Bridge	July 5, 1884	20,000
Below and above Vernon Avenue Bridge	Aug. 5, 1886	37,500
Newtown Creek and Bay	Aug. 11, 1888	25,000
Do	Sept. 19, 1890	35,000
Do	July 13, 1892	35,000
Do	Aug. 17, 1894	20,000
Total		197,500

Amount expended to June 30, 1895, inclusive of outstanding liabilities $197,500

Money statement.

Amount appropriated by act of August 17, 1894	$20,000.00
June 30, 1895, amount expended during fiscal year	20,000.00
Amount (estimated) required for completion of existing project	58,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	58,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

Abstract of proposals for improving Newtown Creek, New York, received in response to advertisement dated September 10, 1894, and opened October 11, 1894, by Second Lieut. Robert McGregor, Corps of Engineers.

No.	Name of bidder.	Dredging. From Vernon avenue to the East River, 22,000 cubic yards. Per cubic yard.	Amount.	From Vernon avenue to Central Oil Works, 16,000 cubic yards. Per cubic yard.	Amount.	From Queens County Oil Works to Nichols Chemical Dock, 36,000 cubic yards. Per cubic yard.	Amount.	Total
1	Morris & Cumings Dredging Co.	$0.35	$7,700.00	$0.35	$5,600.00	$9.22	$7,920.00	$21,220.00
2	Jno. R. Stuyvesant	.35	7,700.00	.25	4,000.00	.25	9,000.00	20,700.00
3	The International Contracting Co.	.55	12,100.00	.55	8,800.00	.50	18,000.00	38,900.00
4	Elijah Brainard	.30	6,600.00	.31	4,960.00	.29	10,440.00	22,000.00
5	The W. H. Beard Dredging Co.	.31	6,820.00	.30	4,800.00	.25	9,000.00	20,620.00
6	Thomas Potter	.27	5,940.00	.27	4,320.00	.24	8,640.00	*18,900.00
7	J. H. Fenner	.37	8,140.00	.84	13,440.00	.38	13,630.00	35,260.00

* Lowest bid in the aggregate.

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COMMERCIAL STATISTICS.

The commercial statistics for the fiscal year ending June 30, 1890, have remained practically unchanged, and are therefore herein repeated.

Imports and exports.

Articles.	Amount.		Value.
	Imported.	Exported.	
Lumber.....feet, B. M..	263,040,852	21,000,000	$5,238 [illegible]
Coal.....tons..	440,410	.....	1,65[illegible]
Oil.....{cases....	.....	2,937,273	2,9[illegible]
Oil.....{gallons..	19,949,255	29,252,557	3,02[illegible]
Residuum.....do....	20,093,200	1,378,148	62[illegible]
Grain.....bushels..	140,000	.....	14[illegible]
Brick.....do....	125,000,000	.....	65[illegible]
Lime and cement.....barrels..	260,000	.....	26[illegible]
Stone and sand.....tons..	105,000	.....	10[illegible]
Chalk.....do...	20,000	.....	7[illegible]
Tin, lead, iron, and steel.....do...	9,776	500	96[illegible]
Oil of vitriol.....pounds..	20,457,437	.....	13[illegible]
Jute, hemp, manila, etc.....tons..	200,000	.....	2,00[illegible]
Empty barrels and cases.....	577,058	1,036	46[illegible]
Naphtha.....gallons..	.....	6,464,226	38[illegible]
Candles and wax.....pounds..	.....	11,765,064	.....
Separated acid.....gallons..	.....	1,035,695	19[illegible]
Miscellaneous.....tons..	.....	24,075	2,23[illegible]
Total.....	.....	.....	22,045,74[illegible]

Vessels arriving and departing.

Class.	Number.	Tonnage
Steamers	12	15[illegible]
Ships	26	31[illegible]
Barks	125	8[illegible]
Brigs	13	1[illegible]
Schooners	2,226	1,13[illegible]
Lighters	1,022	20[illegible]
Barges	2,782	55[illegible]
Canal boats	3,068	30[illegible]
Total	9,274	2,324,90

There were built on Newton Creek 23 new vessels, 7,200 tons capacity, and valued at $265,000.

E 8.

IMPROVEMENT OF BUTTERMILK CHANNEL, NEW YORK HARBOR.

Buttermilk Channel is the name given to the channel which separates Governors Island at the mouth of the East River, New York Harbor, from the city of Brooklyn.

The channel on the northwest side of Governors Island, which separates it from the lower end of the city of New York, is the wider and deeper of the two, and is the one most used by vessels passing between the East River and other parts of New York Harbor.

Buttermilk Channel was formerly obstructed by three shoals:

(1) A shoal lying above and northeast of Governors Island, projecting into Buttermilk Channel and extending over to the main channel on the other side, which originally had a least depth over it of 9½ feet at mean low water.

(2) A shoal putting out from Red Hook Point on the Brooklyn side and extending up the eastern side of the channel to the entrance to the

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Atlantic Basin, with a least depth on it of about 6 feet at mean low water and an average depth of from 10 feet to 12 feet mean low water.

(3) A shoal putting out from the southern side of Governors Island and extending toward the Red Hook Point Shoal, which is partly dry at mean low water.

Between the first-mentioned shoal and Governors Island there was formerly a narrow channel with 30 feet of water in it, and between this shoal and the Brooklyn shore a channel of the same depth, also originally narrow.

The line of docks and wharves from the Brooklyn Bridge down to the mouth of the Atlantic Basin on the Brooklyn side is one of the most important in the New York Harbor, and this part of the river, extending from the Brooklyn Bridge to Governors Island, was formerly regarded by pilots and masters of vessels as one of the most difficult places in New York waters to carry a vessel through safely on account of this shoal, the rapid current, and the enormous traffic passing not only up and down, but across the stream.

Tows, tugs, small steamers, and small craft generally, in passing up and down this part of the East River, keep to the New York side, forcing the larger class of Sound steamers, ocean steamers, and sea-going ships in tow of tugs to keep over toward the Brooklyn shore, and if, as was often the case, these vessels were obliged to stop in order to avoid collisions with ferryboats, sloops, and canal-boat tows, they were liable to drift upon this shoal.

Upon the statement of these difficulties, made by shipping merchants and others whose business lay along the Brooklyn wharves between Wall Street Ferry and the Atlantic Basin, a survey of this shoal was ordered in 1872, and a project for its improvement was adopted in 1880.

The appropriations made by the several river and harbor acts from June 4, 1880, to August 11, 1888, both inclusive, have been so applied as to complete the removal of this shoal to a depth of 26 feet, mean low water, at an estimated cost of $346,000.

The contract for final work was closed July 3, 1891.

The river and harbor act of September 19, 1890, made provision for the survey of Red Hook Shoal, lying at the southern entrance to the Buttermilk Channel, "opposite the southeast side of Governor's Island," and the report thereon, dated October 17, 1890, states that the shoal contains 1,484,048 cubic yards of material, scow measurement. The estimated cost of removal was $529,000.

During the fiscal year ending June 30, 1894, 345,000 cubic yards of material were removed by contract from the northern end of the shoal, covering a width of 440 feet. The depth gained over this distance was 26 feet at mean low water, and at the close of this work the buoy marking the edge of the deep-water channel was moved back 440 feet toward the Brooklyn shore.

When the shoal is entirely removed Buttermilk Channel, south and west of the entrance to Atlantic Basin, will be 1,000 feet wide, and the set of the currents will be so direct along the southern margin of Governors Island that the improved depth of 26 feet will be maintained in the channel with reasonable certainty without requiring the construction of an artificial bank upon that island or upon the shoal extending from it to the southwestward.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

At the opening of the fiscal year no contract was in force.

The river and harbor act of August 17, 1894, appropriated $50,000 for continuing improvement.

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After advertisement according to law a contract was made with Rittenhouse R. Moore, dated November 8, 1894, for dredging 170,000 cubic yards of material at 25 cents per cubic yard.

Work under this contract was begun May 8, 1895, and at the close of the fiscal year 52,602 cubic yards of material had been removed, and the channel had been widened 80 feet, measured southward from the northern margin of the shoal.

The amount expended during the fiscal year ending June 30, 1895, inclusive of outstanding liabilities, was $13,968.34.

An appropriation of $200,000 is recommended for continuing this improvement, which is required to facilitate navigation through Buttermilk Channel, now obstructed by the Red Hook Shoal.

This work is in the collection district of New York. The nearest port of entry is New York City, and the nearest work of defense is Fort Columbus, New York Harbor. The nearest light-house is Robbins Reef.

AMOUNTS APPROPRIATED.

Application.	Date.	Amount
Dredging	June 4, 1880	$50,000
Do	Mar. 4, 1881	6,000
Do	Aug. 2, 1882	6,000
Do	July 5, 1884	10,000
Do	Aug. 5, 1886	50,000
Do	Aug. 11, 1888	100,000
Do	July 13, 1892	100,000
Do	Aug. 17, 1894	50,000
Total		402,000
Received from other sources		57,000
Total		459,000

Amount expended to June 30, 1895, inclusive of outstanding liabilities $459,000

Money statement.

July 1, 1894, balance unexpended		$935.00
Amount appropriated by act of August 17, 1894		50,000.00
		50,935.00
June 30, 1895, amount expended during fiscal year		4,171.34
July 1, 1895, balance unexpended		46,763.66
July 1, 1895, outstanding liabilities	$9,796.53	
July 1, 1895, amount covered by uncompleted contracts	29,349.50	
		39,146.03
July 1, 1895, balance available		7,617.63

Amount (estimated) required for completion of existing project 354,000
Amount that can be profitably expended in fiscal year ending June 30, 1897 200,000
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

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Abstract of proposals for improving Buttermilk Channel, New York, received in response to advertisement dated September 10, 1894, and opened October 11, 1894, by Second Lieut. Robert McGregor, Corps of Engineers.

No.	Name of bidder.	Dredging of material from Red Hook Shoal, 170,000 cubic yards.	
		Per cubic yard.	Amount.
		Cents.	
1	The International Contracting Co	32	$54,400.00
2	Atlantic Dredging Co	32	54,400.00
3	Jno. Stuyvesant	32	54,400.00
4	W. H. Beard Dredging Co	32 5/16	55,420.00
5	Morris & Cumings Dredging Co	32 3/8	55,037.50
6	Rittenhouse R. Moore*	25	42,500.00

* Lowest bid.

COMMERCIAL STATISTICS.

The commercial statistics for the fiscal year ending June 30, 1890, have remained practically unchanged, and are therefore herein repeated.

The commerce of Buttermilk Channel is so intimately connected with that of New York Harbor that it is impracticable to determine the amount and value.

The number and tonnage of vessels loading and unloading at the Brooklyn wharves immediately fronting on Buttermilk Channel during the fiscal year ending June 30, 1890, as shown by the Maritime Register, is as follows:

Vessels arriving and departing.

Class.	Number.	Tonnage.
Steamers	1,047	1,430,192
Ships	253	389,996
Barks	1,632	783,360
Brigs	312	99,600
Schooners	714	214,200
Total	3,958	2,917,348

This does not include the numerous lighters and canal boats, of which no record is kept.

E 9.

IMPROVEMENT OF GOWANUS BAY, NEW YORK HARBOR—RED HOOK, GOWANUS CREEK, AND BAY RIDGE CHANNELS.

Gowanus Bay is a part of New York Harbor, lying at the mouth of Gowanus Creek, in the southwestern part of the city of Brooklyn. The depth of water in the channel was formerly 7 to 12 feet at mean low water, which was wholly insufficient for the passage of the vessels employed in the commerce of the district. A survey of Gowanus Bay and Creek was made in 1880, and a project for their improvement was submitted in January, 1881.

This project provided for dredging a channel on the north side between the pier lines established by the commissioners appointed by the State of New York in 1875, beginning at the bay and extending up the creek to Hamilton Avenue Bridge, 18 feet at mean low water and 200 feet wide, except for the upper few hundred feet near the bridge, where the width was to be gradually reduced from 200 feet to 100 feet.

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The total length of the proposed channel was about 9,000 feet, and the total estimated cost of improvement was $182,500.

The plan actually followed in carrying out the project included the improvement of Gowanus Creek from Hamilton avenue westward to southwest corner of the Erie Basin; thence northward along the west side of Erie Basin along Red Hook Channel and southerly across the bay to the south side along the Bay Ridge Channel. Both of the latter channels were to be 200 feet wide and 18 feet deep, mean low water.

The estimated cost of this enlarged project was $192,564.

Under appropriations of 1881, 1882, and 1883 the proposed Red Hook branch of the channel was dredged 100 feet wide for a length of 2,000 feet, measured from Red Hook; and the southern channel, running toward Bay Ridge, was begun at the southern end and carried northward for a distance of 1,900 feet, to near Forty-third street, with depths varying from 21 to 17 feet, except for a few hundred feet at the upper end on the eastern side, where the last cut was left unfinished.

The sum of $7,500 was appropriated by the act of August 5, 1886, and was applied toward the improvement of Red Hook and Gowanus Creek Channel, which, at the close of the contract for dredging, March 12, 1887, was 200 feet wide and 18 feet deep from the entrance to the foot of Court street, Brooklyn, and thence 40 feet wide and 15 feet deep to Sigourney street.

A sketch of the work, June 30, 1885, may be found in the Annual Report of the Chief of Engineers for that year, Part I, page 672.

Under the estimates of $192,564.90 only $72,500 had been appropriated to June 30, 1887.

In the Annual Report for 1888, page 615, the local officer stated that the dimensions previously adopted for the two channels were too small in view of the great increase in length and draft which had taken place lately in the construction of sea-going vessels, especially steamers, and recommended that the depth of these channels be increased to 21 feet mean low water, and their width to 400 feet, while to facilitate the handling of vessels in the contracted space near the mouth of Gowanus Creek and to enable those drawing 21 feet of water to pass directly from the Bay Ridge Channel at Fortieth street to the Red Hook Channel at the southwestern entrance to Erie Basin, without requiring them to go to the junction of the channels at Twenty-eighth street, it was further recommended that the triangular shoal area separating the two channels at the entrance be deepened to 21 feet mean low water.

It was estimated that these changes would involve the removal of 1,345,000 cubic yards of material, measured in place at the cost of $600,000, as follows:

Red Hook Channel, 170,000 cubic yards, at 40 cents		$68,000
Gowanus Creek Channel:		
From Henry street to Hamilton Avenue Bridge, 350,000 cubic yards, at 40 cents	$140,000	
Triangular area at mouth, 300,000 cubic yards, at 40 cents	120,000	
		260,000
Bay Ridge Channel, 525,000 cubic yards, at 40 cents		210,000
Contingencies		62,000
Total		600,000

The river and harbor act of August 11, 1888, making appropriations for continuing the improvement, reads as follows:

Continuing the improvement by dredging to 21 feet mean low water, and widening the channel to 400 feet on the northerly side from the foot of Percival street along the wharves to the 23-foot curve opposite the entrance to Erie Basin, $60,000.

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This provided for the commencement of the first and second parts of the project recommended in 1888. The required width of 400 feet at the entrance could not be obtained in Gowanus Creek without interfering with the vested rights of property on the west side to such a degree as to practically prohibit the execution of the project. The project which was accordingly adopted for the application of the appropriation provided that the channel to be ultimately dredged should be 400 feet wide from the entrance to the eastern end of the Erie Basin, and thence 250 feet wide to the foot of Percival street, where provision would be made again for widening the channel by dredging out the three triangular spaces or slips on the north side immediately below that street.

Operations under the contract of February 27, 1889, for the removal of 300,000 cubic yards of material from Red Hook and Gowanus Creek channels, extending from the entrance near the western entrance to Erie Basin to Percival street, were completed February 26, 1891, and the channel was then throughout 100 feet wide and 21 feet deep, mean low water.

The river and harbor act of September 19, 1890, appropriated $60,000 for improving the channel at Gowanus Bay, New York, to be applied on the northerly side (Red Hook and Gowanus Creek channels) from the foot of Percival street along the wharves to the 23-foot curve opposite the entrance to the Erie Basin.

The contract for this work, dated January 8, 1891, was completed April 30, 1892. The channel was then 230 feet wide from entrance to Twenty-eighth street, and 150 feet wide thence to Percival street.

The same act appropriated $100,000 for a channel 400 feet wide and 21 feet deep on the south shore (Bay Ridge Channel) from Twenty-eighth street south along that shore to the 21-foot curve near Bay Ridge.

The contract for this work, dated January 8, 1891, was completed June 18, 1892. The channel was then 120 feet wide from Twenty-eighth street to Thirty-ninth street, and 90 feet wide thence to Sixtieth street.

The adopted project at this date for the improvement of Gowanus Bay therefore contemplated a channel on the north and south sides of the bay, each 400 feet wide and 21 feet deep at mean low water, and the removal also to the depth of 21 feet of the triangular shoal at the entrance to the bay embraced between the two channels.

The river and harbor act dated July 13, 1892, made an appropriation for continuing the improvement of Gowanus Bay channels of $100,000, "for distribution by allotment between the Red Hook and Gowanus Creek channels, at the discretion of the Secretary of War." The allotment, as made by the Secretary of War, was $58,000 for the former and $42,000 for the latter.

The same act appropriated $98,600, for completing the improvement of Bay Ridge Channel.

Harbor lines were established by the Secretary of War March 4, 1890, on both shores of Gowanus Bay.

To remove any misapprehension as to their exact location on the *north shore*, it seems best to repeat that the pierhead and bulkhead lines so established are coincident throughout from the foot of Ferris street to Hamilton avenue, South Brooklyn. They lie *exterior* to the *Erie Basin* and follow to the foot of Court street, the exterior sea-wall line established by chapter 298, Laws of the State of New York, 1875, and thence to Hamilton avenue follow the bulkhead line established by chapter 763, Laws of New York, 1857.

In regard to the harbor lines for the *south shore* of Gowanus Bay (along the Bay Ridge Channel) adopted by the Secretary of War

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March 4, 1890, attention is invited to the fact that "the piers between the adopted pier and bulkhead lines may be filled with solid material when an equal tidal prism is provided in compensation therefor behind the authorized bulkhead lines and adjacent to said piers." (Annual Report Chief of Engineers, 1890, p. 815.)

At the close of the fiscal year ending June 30, 1894, the Red Hook Channel was 350 feet wide and 21 feet deep, mean low water; the Gowanus Creek Channel was 185 to 215 feet wide and 21 feet deep, mean low water, and the Bay Ridge Channel was 375 feet wide and 21 feet deep, mean low water, from Twenty-eighth street south to Forty-second street, South Brooklyn.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

General improvement, Red Hook and Gowanus Creek channels.—At the opening of the fiscal year there was in force the contract with The International Contracting Company, dated January 6, 1893, for removing 645,000 cubic yards of material from Red Hook and Gowanus Creek channels, at 13.7 cents per cubic yard.

Operations under this contract were completed November 7, 1894. The quantity of material removed during the fiscal year was 293,794 cubic yards, and the total amount removed was 649,395 cubic yards. At the close of the contract the Gowanus Creek Channel had been dredged to a depth of 21 feet, mean low water, between the harbor lines on both sides of the creek to the foot of Percival street, and Red Hook Channel had been dredged to the full projected width of 400 feet and depth of 21 feet, mean low water.

Bay Ridge Channel.—At the opening of the fiscal year an open-market agreement was in force with James D. Leary, authorized by the Secretary of War June 29, 1893, for removing 640,000 cubic yards from Bay Ridge Channel, at 13⅝ cents per cubic yard.

Work under this agreement was completed July 31, 1895. The quantity of material removed during the fiscal year was 121,205 cubic yards, and the total amount removed was 641,014 cubic yards. At the close of the contract Bay Ridge Channel had been dredged to the full projected width of 400 feet and depth of 21 feet, mean low water.

The river and harbor act of August 17, 1894, making appropriation for continuing the improvement, reads as follows:

Improving Bay Ridge and Red Hook channels, New York Harbor, New York: Continuing improvement of Bay Ridge Channel by dredging out and opening the same from a point at its junction with the Gowanus Creek Channel (near Twenty-eighth street), southerly therefrom along and in front of Gowanus Bay and Bay Ridge to a point where the said Bay Ridge Channel, so to be opened, encounters a twenty-six-foot contour or depth of water, so that the channel, so to be opened, shall be of a uniform depth of twenty-six feet and a width of eight hundred feet at low water, and continuing improvement of Red Hook Channel from its junction with the Bay Ridge Channel to its connection with the Buttermilk Channel, to obtain a depth of twenty-six feet at mean low water and a width of four hundred feet, one hundred and fifty thousand dollars: *Provided*, That the Secretary of War may, in his discretion, expend twenty thousand dollars of said appropriation in improving Gowanus Creek Channel under the project to obtain twenty-one feet depth of water.

The effect of this legislation is to enlarge the project for the improvement of Gowanus Bay and approaches so as to give the Bay Ridge Channel a width of 800 feet and depth of 26 feet at mean low water; the Red Hook Channel a width of 400 feet and depth of 26 feet at mean low water, and the Gowanus Creek Channel a width of 250 feet and a depth of 21 feet at mean low water.

The total estimated cost of the enlarged project, exclusive of the appropriation contained in the act of August 17, 1894, is $483,300.

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As the full projected depth of 21 feet at mean low water had been gained in Gowanus Creek Channel by the application of the allotment from the appropriation made by act of July 13, 1892, no part of the sum appropriated by act of August 17, 1894, was required for further improvement of that channel.

The Gowanus Creek Channel is an interior one, upon which the main wharves in South Brooklyn are located, and connects directly with Upper New York Harbor by the Red Hook Channel, and with Lower New York Harbor by the Bay Ridge Channel.

After advertisement according to law, a contract was made with The W. H. Beard Dredging Company, dated November 12, 1894, for removing 600,000 cubic yards of material from Bay Ridge Channel and 300,000 cubic yards of material from Red Hook Channel, at 15 cents per cubic yard.

Operations under this contract were begun on Bay Ridge Channel November 27, and on Red Hook Channel December 17. On December 31 all dredges were withdrawn on account of severe winter weather. Work was resumed on Bay Ridge Channel March 4, and on Red Hook Channel on March 7. The quantity of material removed under this contract during the fiscal year was 209,060 cubic yards from Bay Ridge Channel and 132,947 cubic yards from Red Hook Channel.

At the close of the fiscal year the Bay Ridge Channel was 40 feet wide and 26 feet deep, mean low water, and the Red Hook Channel was 120 feet wide and 26 feet deep, mean low water.

The sum of $125,000 is recommended for the fiscal year ending June 30, 1897, for application in continuing the enlarged project for improvement.

Gowanus Bay is in the collection district of New York. Nearest light, Robbins Reef. Nearest work of defense, the fort on Governors Island, 1 mile to the northward.

AMOUNTS APPROPRIATED.

Application.	Date.	Amount.
Dredging	Mar. 3, 1881	$40,000
Do	Aug. 2, 1882	20,000
Do	July 5, 1884	5,000
Do	Aug. 5, 1886	7,500
Do	Aug. 11, 1888	60,000
Do	Sept. 19, 1890	160,000
Do	July 13, 1892	198,600
Do	Aug. 17, 1894	150,000
Total		641,100

Amount expended to June 30, 1895, inclusive of outstanding liabilities .. $542,065.38

Money statement.

July 1, 1894, balance unexpended		$87,903.57
Amount appropriated by act of August 17, 1894		150,000.00
		236,903.57
June 30, 1895, amount expended during fiscal year		121,018.82
July 1, 1895, balance unexpended		116,884.75
July 1, 1895, outstanding liabilities	$17,850.13	
July 1, 1895, amount covered by uncompleted contracts	83,701.65	
		101,551.78
July 1, 1895, balance available		15,332.97
Amount (estimated) required for completion of existing project		483,300.00
Amount that can be profitably expended in fiscal year ending June 30, 1897		125,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

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REPORT OF LIEUT. COL. G. L. GILLESPIE, CORPS OF ENGINEERS.

[Printed in Senate Ex. Doc. No. 43, Fifty-third Congress, third session.]

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., January 16, 1895.

GENERAL: Referring to the appropriation for improving Bay Ridge and Red Hook channels, Gowanus Bay, New York, contained in the river and harbor act of August 17, 1894, I have the honor to report that the amount of money necessary to be appropriated, in addition to that now available, to complete the Bay Ridge Channel to a depth of 28 feet, mean low-water, and width of 800 feet, and the Red Hook Channel to a depth of 26 feet, mean low-water, and width of 400 feet, is shown by the following table, viz:

	Cubic yards
Bay Ridge Channel	1,980,[illegible]
Red Hook Channel	411,[illegible]
Total	2,391,[illegible]

The total cost of removal, at the existing contract price of 15 cents per cubic yard, allowing 10 per cent for contingencies, will be $394,649.[illegible]

In order that shipping may conveniently pass from one channel to the other without going into Gowanus Creek, the foregoing improvement should be extended to include the removal, to the same depth, of the triangular area at the junction of the channels in Gowanus Bay.

The total estimate of cost of improvement under this condition will be:

	Cubic yards
Bay Ridge Channel	1,980,[illegible]
Red Hook Channel	411,[illegible]
Triangular area at junction	537,[illegible]
Total	2,929,[illegible]

The aggregate cost of removal, at 15 cents per cubic yard, and 10 per cent for contingencies, will be $483,303.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

Abstract of proposals for improving channel in Gowanus Bay, New York, received in response to advertisement dated September 24, 1894, and opened October 30, 1894, by Lieut. Col. G. L. Gillespie, Corps of Engineers.

No.	Name of bidder.	Dredging of material from channel in Gowanus Bay, New York, 900,000 cubic yards.	
		Per cubic yard.	Amount
		Cents.	
1	Morris & Cumings Dredging Co.	15½	$140,4[illegible]
2	The W. H. Beard Dredging Co.*	15	13[illegible]
3	Atlantic Dredging Co.	16	144,[illegible]

* Lowest bid.

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COMMERCIAL STATISTICS.

The commercial statistics for the fiscal year ending June 30, 1890, have remained practically unchanged and are therefore herein repeated.

[For the year ending December 31, 1889.]

Receipts and shipments.

Articles.	Quantity.	Value.
Coal.....tons..	687,000	$2,748,000
Brick.....number..	202,000,000	1,414,000
Lumber.....feet, B. M..	147,000,000	2,940,000
Lime, etc.....barrels..	460,000	690,000
Grain.....bushels	2,750,000	1,100,000
Ice.....tons..	230,000	805,000
Roofing tar.....barrels..	75,000	225,000
Building stone, etc.....	.....	647,000
Miscellaneous.....	.....	2,500,000
Total.....	.....	13,069,000

Vessels arriving and departing below Hamilton Avenue Bridge.

Class.	Number.	Tonnage.
Steamers.....	46	33,211
Ships.....	68	105,741
Barks.....	489	441,614
Brigs.....	56	17,627
Schooners.....	281	57,392
Total.....	890	655,585

Vessels arriving and departing above Hamilton Avenue Bridge (record of bridge tender).

	Times opened and closed.	Vessels passed through.	Registered tonnage.	Daily average of times opened.
June 1, 1889, to May 31, 1890.....	8,624	7,668	1,430,664	23
1886.....	7,632	6,071	985,431	21
Increase.....	992	1,597	445,233	7

Classification of vessels.

	Number.	Registered tonnage.	Draft.
			Feet.
Schooners.....	1,393	172,738	6 to 12
Sloops.....	972	62,925	6 to 10
Barges.....	1,625	409,486	6 to 8
Canal boats.....	3,678	785,515	6 to 8
Total.....	7,668	1,430,664	.....

The increase in value of receipts and shipments compared with 1887 is $749,000. It is believed that the values as stated in 1887 are too large, and that the true increase is very much larger.

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BAY RIDGE CHANNEL.

[These statistics are not included in the previous table.]

Receipts and shipments.

Articles.	Value.
Asbestous cement, paint, and roofing	$2, 225 [illegible]
Brick and lumber	[illegible]
Export sugar machinery and castings	175 [illegible]
Petroleum and its products	3, 3[illegible]
Phosphates	[illegible]
Ship and yacht building, dry docks, machine and boiler works, and other industries	1, 0[illegible]
Total	7, 4[illegible]

There are large factories and piers building along the line of the channel, which will enhance the tonnage and values.

Of larger vessels, such as ships, barks, etc., about 300 have been at the docks. From observation it is estimated that there are about 1,200 of smaller craft.

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IMPROVEMENT OF NEW YORK HARBOR, NEW YORK.

New York Harbor is the name applied to the waters surrounding the city of New York, comprising parts of the Hudson, East, and Harlem rivers, and the Upper and Lower bays, lying respectively inside and outside of the Narrows, and between the Long Island, Staten Island, and New Jersey shores.

The city of New York, from which the harbor takes its name, lies at the mouth of the Hudson River at its junction with the East River, and with the adjacent cities of Brooklyn and Jersey City, which are but the natural outgrowths of New York energy and enterprise, includes a population of nearly 3,000,000 inhabitants, which is more than the population of any State in the Union, excepting New York, Pennsylvania, Ohio, Illinois, and Missouri.

At this port two-thirds of the merchandise imported into the United States is received and two-thirds of the import duties are collected. From this port are sent one-half of the domestic products of the country which are exported, and here one-half of the foreign tonnage trading with the United States enters. Three-fourths of the passengers traveling between the United States and foreign countries come and go by the way of New York, and three-fifths of all immigrants land at this port.

New York Harbor has two entrances, one by the East River and Hell Gate, leading into Long Island Sound, used chiefly by vessels trading between New York, the Eastern States, and British American Provinces; the other, which is the main entrance, leading out through the Narrows, by Sandy Hook, directly into the Atlantic Ocean, and used by all the transatlantic steamers and vessels.

The Hell Gate entrance has been in course of improvement since 1869, and with its successful completion—which is now assured within a few years—and with the steady growth of the city toward the north it must come more than ever into use by foreign-bound vessels.

The main or Sandy Hook entrance into New York Harbor is one of the best in the world. The channel prior to 1884 was less than 24 feet

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deep at mean low water, and nearly 29 feet at mean high water, with abundant breadth, and was ample for all the commercial requirements of the port until the great increase in the length, tonnage, and draft of the transatlantic passenger steamers made further deepening necessary in order to prevent the delays to which they were subjected by having to wait for high water in order to pass either in or out.

Before the improvement of the Main Ship Channel into New York Harbor was undertaken by the United States it was obstructed by four shoals, as follows:

1. The outer bar, about 4,000 feet wide, the channel across which is known as Gedney Channel, where there were depths of 23.7 feet in mid-channel and 22.3 feet in the southern half.

2. The shoal at the mouth of the Swash Channel, about 4,000 feet wide, where the depth was 24.3 feet.

The channel across this shoal has been named the Bayside Channel.

3. The shoal northwest of Sandy Hook, about 2,000 feet wide, on which the least depth was 26.2 feet.

4. The shoal in the Main Ship Channel in the Lower Bay, west of Flynn Knoll, nearly 3 miles long, on the crest of which the depth was only 23.9 feet in mid-channel, with depths of 22.6 feet within a few hundred feet of the mid-channel range.

A large proportion of the vast commerce of the port, which was carried on in vessels of great draft, could only cross these shoals at or near high water.

The reasonable demand which had been made in 1884 by commercial bodies residing in New York City, that increased facilities should be afforded for entering the port of New York by the Sandy Hook route, was recognized in the river and harbor act of July 5, 1884, which provided for "deepening Gedney Channel through Sandy Hook Bar, New York, $200,000."

A few words upon the subject of the lower harbor and of the various channels across the bar at the entrance are here necessary for a proper understanding of the causes which led to the adoption of the Main Ship Channel for improvement.

Gedney Channel is the main channel across the ocean bar, lying at the entrance to New York Harbor, about 3 miles outside of Sandy Hook, and east by north of it. Sandy Hook lies about 9 miles outside of and nearly south from the Narrows, the name given to the strait separating the nearest points of Long Island and Staten Island; and the Narrows, in turn, are about 7 miles south from the Battery at the extreme southern end of Manhattan Island, upon which New York is situated. The Narrows are about 1 mile wide. That part of New York Harbor lying outside of the Narrows is commonly known as the "Lower Bay."

From the Narrows northward to New York City there is no water less than 6 fathoms (36 feet) deep in the main channel.

Lower Bay is a large tidal basin, with an area of about 100 square miles, estimating inside or northward and westward of a line drawn from Sandy Hook to Coney Island.

The western end of the bay, formed by Sandy Hook, the adjacent Jersey shore, and Staten Island, is known as Raritan Bay, and the southern part of it, inside the peninsula of Sandy Hook, is known as Sandy Hook Bay, or more commonly as the Horseshoe.

From the northwest around by the east to south-southeast the lower bay is open to the full sweep of the Atlantic Ocean.

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From the Narrows to the northern point of Sandy Hook is about 9 miles, but the shortest distance across the bay from the point of Sandy Hook to Coney Island is 7 miles. The water cross section on this line at mean low water is about 790,000 square feet, through which the mean velocity is approximately 1.6 feet per second; but the maximum velocities are approximately twice as great. (Board of Engineers' Report for 1884.)

At the Narrows the channel is 1 mile wide and 70 feet deep, with depths in it of over 100 feet.

Below the Narrows there is one main channel, commonly known as the Main Ship Channel, running southward to a point about 1 mile west of the upper end of Sandy Hook, thence turning at right angles northward and eastward for 4 miles to the head of Gedney Channel, and thence through Gedney Channel east to the deep waters of the ocean.

But along and inside the above-mentioned cross section, 7 miles, between Sandy Hook and Coney Island, there is a wide shoal with five distinct channels of varying depths running through it seaward and eastward.

They lie in the following order, beginning at the northward:

(1) *The Coney Island Channel.*—In which the navigable depth at mean low water is 10 feet.

(2) *The Fourteen-foot Channel.*—In which the navigable depth at mean low water is 15 feet.

(3) *The East Channel.*—In which the navigable depth of water is 19 feet.

(4) *The Swash Channel.*—Through which 22 feet can be carried at mean low water in a narrow channel.

(5) *The Main Ship Channel.*—In which, prior to 1885, 24 feet only could be carried through different reaches with lumps in them, over which the depth was only 23.3 feet at mean low water. The northern reach, which passes along the west side of Flynn Knoll, is maintained by tidal flow through the Narrows; and the southern reach, along Sandy Hook, is maintained by tidal flow through Raritan Bay.

These five channels are separated by shoals with from 4 to 18 feet of water over them at mean low water.

The first three of these channels head directly out into the open sea, but the two latter converge into an area of about 2 miles square, lying north and east of Sandy Hook, which has a depth in it of 30 feet of water and over, and from this deep area two channels lead eastward into the open sea over the outer bar, the northernmost known as Gedney, the southernmost as the South Channel, both of which had, prior to 1885, only 24 feet of water in them at low water. Gedney Channel, the wider, was originally the deeper and straighter of the two, and was therefore used by all the large vessels.

The Swash Channel is really a cut-off from the Main Ship Channel, leaving it about 6 miles below the Narrows, and joining it again at the western end of Gedney Channel.

Apart from being shoaler, the Swash is much narrower than the Main Ship Channel.

The distance from the Battery, at New York, to 30-foot soundings outside the bar in Gedney Channel is 22 miles, and by the Swash it is 18 miles, or from the Narrows 15 and 11 miles, respectively.

As the appropriation of 1884 was made in advance of an approved project, the local officer was authorized and directed to make a survey of the Lower Harbor from the eastern end of Coney Island to Sandy Hook, with a view of determining the most feasible plan of improve-

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ment. The survey was completed in November, 1884, and a report recommending the improvement of Gedney Channel and the eventual improvement of the Main Ship Channel, accompanied with estimates of cost and chart, was submitted December 6, 1884. (Annual Report, Chief of Engineers, 1885, p. 773.)

The navigation of the Main Ship Channel inside the bar, especially on the approach to the Narrows from the Southwest Spit, is so intimately connected with that of Gedney Channel, across the bar, that it was deemed important, in submitting an estimate of cost for the improvement of the latter channel directed to be made by Congress in the act of 1884, to extend the estimate to include the entire Main Ship Channel at Flynn Knoll, and to recommend that the improvement at several intermediate shoals should take place simultaneously. The project providing for deepening the channel across the bar to 28 feet by dredging, and for the contingent construction of a stone dike on the north side of the harbor, which had been recommended by a Board of Engineers December 24, 1884, received the approval of the Secretary of War December 27, 1884. (Annual Report, Chief of Engineers, 1885, Part I, p. 774.)

The project under which the improvement began provided for improving the western end of Gedney Channel for a length of 4,000 feet, measured along its axis, and the Main Ship Channel, west of Flynn Knoll, from Buoy No. 10, at the western end of the Southwest Spit, north to Buoy No. 12, then situated 1½ miles south of the western entrance to Swash Channel, the depth to be 30 feet, mean low water.

The cost was estimated at $970,000, not inclusive of any allowance for irregularities of cutting or for increase of bulk for scow measurements. After the work had progressed for one year, and these allowances could be estimated with some degree of accuracy, the estimate was revised, and the cost of executing the project as then approved was fixed at $1,370,000.

The river and harbor act of August 5, 1886, containing provisions for continuing the improvement at the entrance to New York Harbor, reads as follows:

Improving New York Harbor, New York: To secure a 30-foot channel at mean low water at Sandy Hook entrance of the harbor, upon such a plan as the Secretary of War may approve, $750,000.

By the specific wording of this act Congress gave an express approval of an improvement which contemplated a navigable channel 1,000 feet wide and 30 feet deep, mean low water, through the Main Ship Channel and Gedney Channel, and all subsequent acts have confirmed the provisions of the act of 1886.

In 1887 the project was enlarged so as to embrace a length of 4,500 feet in Gedney Channel, measured along the axis, or a length of 6,000 feet measured along the north side; to remove the shoal in the Main Ship Channel at the south entrance to the Swash Channel, afterwards called the "Bayside Channel;" to remove the shoal northwest of Sandy Hook, and to extend the Main Ship Channel north from Buoy No. 12 to and beyond the north entrance to the East Channel at Buoy No. 14 (now Buoy No. 10). The total estimated cost of the project so enlarged, based on the existing prices for dredging, was $1,490,000.

The river and harbor act of August 11, 1888, appropriated $380.000 for continuing the improvement.

The river and harbor act of September 19, 1890, appropriated $160,000 for continuing the improvement, making the total amount appropriated at that date $1,490,000, the total estimated cost of the improvement.

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Operations for improving the lower bay, under project to provide a navigable channel 1,000 feet wide and 30 feet deep, mean low water, from the sea along Gedney Channel and the Main Ship Channel, were begun September 26, 1885, and completed October 10, 1891.

The plant which was used consisted solely of centrifugal pumps, installed in steamers, and the excavations were all dumped at sea in 14 fathoms of water in the vicinity of the Scotland Light-Vessel. After the completion of the project, the steam dredge last used by the contractors was purchased by the Government, and has since been used to trim banks and corners to facilitate navigation and to provide means for maintaining the improved channel.

The quantities of material removed from the several reaches of the channels improved from September 26, 1885, to June 30, 1892, were as follows:

	Cubic yards.
From Gedney Channel	1,161,244
From Bayside Channel	448,313
From Northwest Shoal	118,758
From west of Flynn Knoll	3,146,764
Total quantity excavated	4,875,079

SHORE PROTECTION AT SANDY HOOK, NEW JERSEY.

The protection of the eastern and northern shores of Sandy Hook, composed of irregular sand dunes, against wave and current action, forms part of the project for improvement of the Main Ship Channel through the lower harbor, but as the work required to be done there was necessarily tentative, it was deemed best to limit expenditures to small sums of money annually while studying the most economical plan of improvement.

Sandy Hook, like the more southerly part of the coast of New Jersey, where the foreshore is a long, submerged shoal, has had a varied experience in changes of form and extent resulting from tidal and current action, supplemented by wave actions during storms.

The eastern shore along False Hook Channel is a long, unbroken beach, remarkably uniform in its contours, and, as it is under the cover of the outlying shoals, has undergone few changes, either of accumulation or degradation.

From the northwest corner of the Spit, where the outer shoal has diminished width, westward around the Hook to beyond the Hook Beacon, the north shore is open to northerly and easterly storms and is particularly subject to frequent changes, and it is on this front that the shore protections have been laid.

The great ravages by the sea in 1863 made shore protection an immediate necessity, and during the following twenty years many points were protected along the crown of the Hook from east to west, the improvements taking the form of jetties extending out, at varying angles with the shore line, from near high-water to below low-water mark.

The Main Ship Channel hugs this shore, and the water at a distance of less than 2,000 feet has a depth of over 60 feet. The slope of the foreshore is somewhat steep, and as the main object of the improvement was to preserve the high-water line and the dunes behind it, there being no marked tendency of the currents to cut below the low-water line, it was thought best to place the outer ends of the jetties near the latter curve. To have anchored the jetties in deep water, under the circumstances, would have been unjustifiably expensive.

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Some of the jetties were built of timber, some of timber, brush, and broken stone, and others of concrete, either in bags or in forms. In 1883–84 the timber jetties, which were in a state of decay, were wholly replaced by concrete, built in place and arranged in sections 10 feet long, so that when undermined, either at the ends or on the sides, settlement would be by sections, without fracturing the body of the jetty.

The cement used was a brand of American Portland. The general cross-section area of the jetties was 50 square feet. While these jetties served to cover a certain part of the shore line for certain winds, it was noticed that they gave no protection to the high-water line during storms from any direction which were coincident with spring tides. In the latter case, no matter what the direction of the wind, the cliffs at or near the high-water mark were attacked and degraded by the waves.

To prevent the complete destruction of the cliffs and to arrest the recession of the high-water line before the foundations of the defenses and other public buildings were reached it was decided, in 1890, to run a riprap wall just below the high-water line completely around the Hook, uniting all the jetties.

The work which was begun in May, 1890, was continued to completion in September, 1891. The wall is 2,575 feet long, extending from Jetty No. 1 to about 119 feet westward of Jetty No. 11, and had a cross section when first laid of 50 to 60 square feet.

The stones vary in weight from 300 pounds to 3 tons and are laid directly upon the beach, with the purpose that each stone shall arrange its bed at once after the sea attack, allowing a gradual settlement of the wall without sudden dislodgment of the stone. The cost was $6 per running foot of wall.

During the past four years the whole wall has settled gradually, with very little lateral displacement of stone, but it has perfectly shielded the cliffs during the northerly and easterly storms, while the jetties have caused the beach pockets to fill up during the intervals of southerly seas, causing the low-water line to move outward. As the result of the improvement the beach is gradually building up and the high-water line is moving outward.

Authority was granted by the Chief of Engineers June 6, 1894, to expend the sum of $2,000 for the protection of the beach in front of the pneumatic gun battery, located 800 feet, approximately, westward from the extreme western jetty near the Hook Beacon.

When this battery was located, in June, 1889, the site was high and well inland, but the unprotected shore line in front receded so much during 1892, 1893, and 1894 that by June of the latter year the sea at high water washed the foundations of the battery and endangered the work.

A riprap wall was laid, with the allotted sum of $2,000, around the front of the battery, conformable to the method followed in building the shore protection to the eastward, which gave sufficient protection till means could be provided for extending the protection eastward to connect with the old work at the beacon.

The amount expended on the improvement of New York Harbor for maintaining and increasing navigable facilities during the fiscal year ending June 30, 1894, inclusive of outstanding liabilities was $70,964.63.

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WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

No contract was in force at the beginning of the year, as the work of improvement was carried on by hired labor, employing the U. S. steam dredge *Gedney*, which was purchased in 1892.

The river and harbor act of August 17, 1894, appropriated $75,000 for continuing the improvement.

The steam dredge *Gedney* was employed at the southern entrance to Main Ship Channel, from buoy C 2 to turning buoy No. 12, until December 10, and was then withdrawn for repairs.

On application of the local officer in charge of the improvement of Savannah Harbor, Georgia, approved by the Chief of Engineers November 23, the steamer was transferred to that work for temporary services. The vessel left New York Harbor December 28, and returned June 7, 1895, at which latter date it was placed on the ways for repairs.

From July 1 to December 10, 1894, the dredge removed from the Main Ship Channel 126,486 cubic yards of material, at a cost of 12½ cents per cubic yard, including expenses of every kind.

The resurvey of the Swash Channel, completed in December, 1894, shows that the work of the dredge in that channel during last year has resulted in a channel 1,000 feet wide and 25 feet deep, mean low water.

No work was done during the fiscal year on the sea wall and jetties built for the protection of the north shore of Sandy Hook, in connection with the channel improvement.

The wall and jetties continue to give satisfaction in protecting the shore against erosion.

The western part of the Hook has receded 70 feet to the eastward during the year, and the north shore has moved out bodily along the whole line, in places as much as 300 feet, giving increased protection to Government buildings and works.

The survey of the Lower Harbor, made during the autumn of last year, indicates that the Main Ship Channel has been maintained in a condition most satisfactory to the navigation of the port. Not only has there been no decline at any point where work had been temporarily suspended, but there has been a measurable increase of depth everywhere, from the northern entrance to the Swash Channel southward and eastward to and over the bar beyond Gedney Channel.

The American Line of transatlantic steamers leave habitually on sailing days at 11 o'clock a. m., regardless of the stage of the tide, and no shoal water during passage outward has been reported to this office.

Liberal appropriations for maintaining this important highway are earnestly recommended.

The amount expended on the improvement of New York Harbor during the fiscal year ending June 30, 1895, inclusive of outstanding liabilities, was $34,888.99.

The amount received from hire of dredge during its operations at Savannah, Ga., was $13,700.

An appropriation of $125,000 is recommended to provide running expenses of the steam dredge *Gedney* for two years.

The operations in and about New York Harbor have been supervised by Mr. G. W. Kuehnle, assistant engineer, to whom I am indebted for the most satisfactory and intelligent service rendered in the discharge of his various trusts.

The work is in the collection district of New York; nearest light-houses, Sandy Hook and Highland lights. The nearest forts are the fort at Sandy Hook and those at The Narrows.

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AMOUNTS APPROPRIATED.

For Gedney Channel, by act July 5, 1884	$200,000.00
For New York Harbor:	
Act August 5, 1886	750,000.00
Act August 11, 1888	380,000.00
Act September 19, 1890	160,000.00
Act July 13, 1892	170,000.00
Act August 17, 1894	75,000.00
Total	1,735,000.00
Received from other sources	13,700.00
	1,748,700.00
Amount expended to June 30, 1895, inclusive of outstanding liabilities	1,673,925.61

Money statement.

July 1, 1894, balance unexpended	$20,963.38
Amount appropriated by act of August 17, 1894	75,000.00
Received from other sources	13,700.00
	109,663.38
June 30, 1895, amount expended during fiscal year	32,994.89
July 1, 1895, balance unexpended	76,668.49
July 1, 1895, outstanding liabilities	1,894.10
July 1, 1895, balance available	74,774.39

Amount that can be profitably expended in fiscal year ending June 30, 1897 125,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

The commercial statistics for the fiscal year ending June 30, 1890, have remained practically unchanged, and are therefore herein repeated.

The following statement concerning the commerce of New York Harbor is taken from the Report of the Chamber of Commerce of the State of New York for the year 1889-90:

Articles.	Imported.		Exported.		Total value.
	Quantity.	Value.	Quantity.	Value.	
Sugar.....pounds..	1,463,051,343	$42,943,453			$42,943,453
Molasses.....gallons..	8,498,875	1,424,251			1,424,251
Coffee.....pounds..	455,979,016	58,860,319			58,860,319
Tea.....do....	58,476,531	9,643,514			9,643,514
Manufactures of wool silk, cotton, and flax.....		111,234,883		$7,728,397	118,963,280
Cotton.....pounds..			536,614,048	54,701,315	54,701,315
Leather and hides.....		25,750,160		4,906,214	30,666,374
Tin.....pounds..	327,279,151	14,825,588			14,825,588
Raw silk and wool.....do....	5,505,689	13,949,577			13,949,577
Hemp, jute, sisal grass, etc.tons..	149,263	13,431,215			13,431,215
India rubber and gutta-percha, crude.....pounds..	28,652,361	11,094,063			11,094,063
Tobacco, and manufactures.....		10,147,883		15,291,084	25,438,967
Furs, and manufactures.....		4,748,971		4,724,017	9,472,983
Earthen, stone, and china ware....		3,230,780			3,230,780
Wines.....		6,156,821			6,156,821
Coin and bullion.....		7,274,618		69,724,274	76,998,892
Precious stones.....		9,498,209			9,498,209
Miscellaneous.....		135,203,820		75,006,102	210,209,922
Breadstuffs:					
Wheat.....bushels..			9,086,407	8,449,510	8,449,510
Wheat flour.....barrels..			3,335,195	15,498,193	15,498,193
Corn.....bushels..			26,658,970	13,066,961	13,066,961
All other breadstuffs.....				1,765,287	1,765,287
Provisions.....pounds..			753,007,846	64,504,425	64,504,425
Mineral oils.....gallons..			418,773,072	36,049,956	36,049,956
Cattle.....			75,004	6,204,624	6,204,624
Oil cake and meal.....pounds..			231,034,183	3,032,066	3,032,066
Foreign merchandise.....				16,727,560	16,727,560
Total.....		479,428,125		397,379,985	876,808,110

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The foregoing table shows an increase of $24,642,419 over the total value of imports and exports for the preceding year, which amounted to $852,165,691.

Commercial statistics of the port of New York from July 1, 1894, to July 1, 1895.

Amount of revenue collected	$104,1[illegible]
Value of all imports	513,[illegible]
Value of all exports	421,[illegible]
Value of all in transit and transshipment trade	39,0[illegible]

	Number.	Register tonnage.
Foreign vessels entered	3,315	5,77[illegible]
Foreign vessels cleared	3,228	5,4[illegible]
American vessels from foreign ports	1,022	1,10[illegible]

Number and tonnage of all vessels belonging to the port of New York July 1, 1895.

	Number.	Register tonnage.
Steam vessels	1,033	461,[illegible]
Sailing vessels	1,396	274,[illegible]
Barges	598	129,[illegible]
Canal boats	30	5,67[illegible]

E 11.

IMPROVEMENT OF JAMAICA BAY, NEW YORK.

Jamaica Bay is a tidal bay, situated on the south side of Long Island near the western end, whose waters flow into the Atlantic Ocean through Rockaway Inlet.

Inside the entrance there is a deep-water basin, from which one navigable channel leads to the northward in the direction of Canarsie, and another, called Beach Channel, to the eastward, behind Rockaway Beach, in the direction of Far Rockaway. From the eastern terminus of one of the branches of the latter channel, which passes through Conch Hole, an artificial cut into Far Rockaway Bay was made several years ago by citizens to enable small boats to pass eastward through that bay into Hempstead Bay and beyond.

The river and harbor act of September 19, 1890, contained provision for a survey "from Main Channel from Jamaica Bay easterly to Long Beach Inlet, for canal."

The usual preliminary examination was made according to law, and the local officer stated in his report, dated December 16, 1890 (*Annual* Report Chief of Engineers, 1892, p. 840), that in his judgment the western part only of the waterway mentioned in the act, extending from the Main Ship Channel, Jamaica Bay, easterly through Conch Hole, to the Citizens Cut at Far Rockaway, was "worthy of improvement," to the extent of opening a connecting channel 60 feet wide, affording 5 feet depth at mean low water.

A survey of the bay was authorized to be made, and a report was submitted thereon October 29, 1891 (Annual Report Chief of Engineers, 1892, p. 845), which gave estimates of cost for the opening of a new waterway across the eastern part of the bay 60 feet wide and 5 feet deep mean low water, following three different routes, viz:

1. From Conch Hole to western end of Citizens Cut	$21,406
2. From entrance to Bass Channel to Citizens Cut	18,920
3. From entrance to Bass Channel to foot of Bayswater avenue, Far Rockaway	9,460

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The river and harbor act of July 13, 1892, appropriated $9,460 for "completing improvement in accordance with plan numbered 3, of Lieutenant-Colonel Gillespie, Corps of Engineers, submitted December 16, 1890."

This was the first appropriation ever made for the improvement of the eastern part of Jamaica Bay.

Operations under contract for the execution of the approved project were completed September 20, 1893, at which date the improved channel was 60 feet wide and 5 feet deep at mean low water from Main Ship Channel through Conch Hole to within 400 feet of the bulkhead at the foot of Bayswater avenue, Far Rockaway.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

As no funds were available no work was done during the year.

No appropriation is recommended for the fiscal year ending June 30, 1897, since the appropriation made by the river and harbor act of July 13, 1892, was for the full amount estimated to be required for the completion of the project.

Jamaica Bay is in the collection district of New York. The nearest fort is at Fort Hamilton, Gravesend Bay, and the nearest light-house is located upon Norton Point, Coney Island, New York Bay.

Money statement.

Amount appropriated, act of July 13, 1892	$9,460.00
Amount expended to June 30, 1895	9,460.00

COMMERCIAL STATISTICS.

The amount of commerce which it is alleged will be benefited by the improvement has been estimated at 500,000 tons. The vessels which now navigate the eastern part of Jamaica Bay are usually of the class engaged in the oyster trade, and number 100, probably. A larger class of boats may be drawn into the trade on the completion of the project for improvement.

E 12.

IMPROVEMENT OF RARITAN BAY, NEW JERSEY.

Raritan Bay forms the western part of the large triangular bay inclosed between Sandy Hook, the New Jersey shore, and Staten Island, the eastern part of which is commonly known to New Yorkers as the Lower Bay, as it lies just outside of or below New York Harbor, which is the name usually applied to the inner body of water on which the city of New York is situated.

The Raritan River flows into Raritan Bay at its extreme western end, passing between Perth Amboy and South Amboy, and Newark Bay is connected with both the Raritan River and Bay by the Arthur Kill, or Staten Island Sound, which, separating Staten Island, belonging to the State of New York, from the New Jersey shore, enters Raritan Bay at Perth Amboy.

The depth of the bay varies from 5 to 30 feet, decreasing gradually toward its western and southern shores.

The natural channel leading out of it toward the eastward after passing the Great Beds Light at the junction of Staten Island Sound and

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the Raritan River does not follow the middle of the bay, but hugs the Staten Island shore for nearly 4 miles to Seguine Point, situated about half a mile east of Princess Bay Light, when it runs southeastwardly toward the inner point of Sandy Hook about 2 miles, crossing a shoal which puts out toward the southward from the Staten Island shore.

In 1880, before any improvement had been made here by the Government, 18 feet at mean low water could be carried through from Perth Amboy to Great Beds Light, 21 feet from Great Beds Light to Seguine Point, and 14½ feet from Seguine Point eastward across the shoal to the deep water in the outer bay.

The width of this shoal between the 21-foot curves was about 8,000 feet.

Through the middle of the bay, south of this channel from Great Beds Light directly toward Sandy Hook, only 11 feet of water could be carried over the shoals.

The above depths all refer to mean low water.

A survey of this bay was ordered in 1880 with the view of ascertaining the practicability of securing a greater depth of water from the Main Ship Channel in the lower bay to the wharves at Perth Amboy, as vessels were often much delayed in crossing the shoal east of Seguine Point.

The estimated cost of dredging a channel 300 feet wide and 21 feet deep, mean low water, from Seguine Point southeastward to the deeper waters of the bay outside, was $126,500. (Annual Report Chief of Engineers, 1881, Part I, pp. 717–719.)

From March 3, 1881, to July 5, 1884, $120,000 was appropriated for this improvement, and a survey which was made in May, 1885, showed that the improved channel at that date had an average width of 250 feet and a least depth of 18 to 20 feet mean low water.

In 1885 the project was extended by providing for excavating a channel 300 feet wide and 21 feet deep from Great Beds Light to deep water at Ward Point, opposite to Perth Amboy. This channel, taken in connection with its extension to the eastward of Seguine Point, would give a continuous 21-foot channel from the Main Ship Channel in New York Bay to the wharves at Perth Amboy. The modified project of 1885 further called for dredging a channel from Great Beds Light to South Amboy, 4,500 feet long, 300 feet wide, and 15 feet deep mean low water. The cost of dredging these two channels and restoring the original width in the cut east of Seguine Point was estimated at $114,000, which sum was increased in 1888 to $120,000 to provide for the shoaling which had taken place in the interval of three years. (Annual Report of the Chief of Engineers, 1885, Part I, p. 758.)

The appropriation act of August 5, 1886, was $37,500, and was applied to completing the channel west of Ward Point, 300 feet wide and 21 feet deep, and in excavating a channel 315 feet wide and 21 feet deep across the crest of the shoal leading from the bend toward Seguine Point, but the funds were not sufficient to complete the whole of the projected work at that point.

It was stated in the original project of 1881 that the Seguine Point Channel would have to be maintained by dredging. The detailed survey, which was made in 1888 from the eastern end of Seguine Point Channel to Perth Amboy, showed that considerable shoaling had taken place, both in the improved channel and over a large stretch west of Princess Bay Light, where deep water formerly existed. This fact made it necessary in 1889 to submit revised estimates for the further

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improvement of the channels leading to Perth Amboy and to South Amboy. (Annual Report Chief of Engineers for 1889, Part I, p. 796.)

Revised estimates.

	Cubic yards.
(1) For a channel 300 feet wide and 21 feet deep, mean low water, from New York Lower Bay to Perth Amboy, the following dredging will be required:	
(*a*) From 21-foot curve, New York Lower Bay, to 21-foot curve off Seguine Point	347,368
(*b*) From Princess Bay, around Red Buoy 8, toward Great Beds Light.	154,130
Total dredging	501,498
(2) For a channel 300 feet wide and 15 feet deep, from Great Beds Light to South Amboy, the dredging required will be	200,000

These estimates were made on the basis of an allowance of 1 foot overdepth and for one-third increase in bulk for scow measurements.

Total dredging required for the completion of the two projected channels, cubic yards	701,498
Estimated cost of the proposed dredging	$175,375

The river and harbor act of August 11, 1888, appropriated $25,000 for continuing the improvement, and on the 27th of February, 1889, contract was made for the removal of 120,000 cubic yards of material from Raritan Bay; 80,000 cubic yards to be removed from the channel across the shoal off Seguine Point, securing 21 feet depth, and 40,000 cubic yards from the channel leading across shoal at Great Bed Light to South Amboy, securing 15 feet depth, mean low water.

The river and harbor act of September 19, 1890, appropriated $40,000 for continuing the improvement.

It may be noted in regard to this improvement that the deep-water channel, which has been said to hug the south shore of Staten Island as far east as Seguine Point, is the *ebb* channel, while the channel on the southern border of Round Shoal, through the center of the bay, heading on the line joining Seguine Point, north shore, and Conaskonk Point, south shore, is the *flood* channel. These two channels slightly overlap, passing each other at a distance of 7,000 feet.

The connection of these channels by an improved channel starting at Seguine Point and running southeast toward Sandy Hook is an unnatural connection, and it was stated in the original report in 1881 that the channel so projected would require annual dredging for its maintenance.

The experience of all the contracts which have been made for this improvement confirms the prediction of 1881. It would have been better, had sufficient funds been available in the beginning, to have extended the flood channel by dredging almost due west until it intersected the ebb channel a short distance to the eastward of the Great Beds Light. Then the ebb and flood would have probably followed the same path and there would have been a better prospect of having the channel maintained by tidal scour.

The width of the intervening shoal is about 12,000 feet, and the average depth of water is 13 feet, approximately, between the 21-foot curves.

This will be the future channel which will connect the head of the Raritan Bay with the Amboys. A limited amount of dredging may be done annually in the Seguine Point Channel to maintain a 21-foot depth for vessels until commerce demands a more direct and convenient route across the shoal now lying at the western end of the bay.

The appropriation of $40,000, act of September 19, 1890, was applied toward the improvement of the Seguine Point Channel and the South

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Amboy Channel. The contract for the former was completed September 24, 1891, and the channel was then 180 feet wide and 21 feet deep, mean low water. The contract for the latter was completed July 8, 1891, and the channel was then 170 feet wide and 15 feet deep at mean low water.

The river and harbor act of July 13, 1892, appropriated $40,000 for continuing the improvement of the two channels, the South Amboy Channel being then 170 feet wide and 15 feet deep at mean low water, and the Seguine Point Channel 180 feet wide and 21 feet deep.

The work was let to contract October 6, 1892, which provided for the removal of 83,000 cubic yards from the South Amboy Channel and 105,000 cubic yards from Seguine Point Channel. The project for the former was completed May 13, 1893, at which date the channel was 250 feet wide and 15 feet deep. Work was begun upon the Seguine Point Channel May 22, 1893, and was completed July 10, at which date the channel was 250 feet wide and 21 feet deep, mean low water.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

No operations were in progress at the beginning of the fiscal year.

The river and harbor act of August 17, 1894, appropriating $40,000 for continuing the improvement, provided for "a survey between South Amboy and Great Beds Light with a view to deepening the channel to 21 feet at mean low water."

The work by dredging was advertised according to law, and on October 30, 1894, a contract was made with Thomas Potter for the removal of 120,000 cubic yards of material from Seguine Point Channel at 14.9 cents per cubic yard, scow measurement, and of 96,000 cubic yards from South Amboy Channel at 17¾ cents per cubic yard, scow measurement.

Work under this contract was begun on Seguine Point Channel November 10, 1894, and continued until December 17, when stormy weather and ice compelled its suspension. Operations were resumed on May 21, 1895, and completed June 24, at which date 123,944 cubic yards of material had been removed, giving a channel 100 feet wide and 21 feet deep from east to west across the obstructing shoal.

Work began on South Amboy Channel April 22, 1895, with one clam-shell dredge, and was completed June 27, at which date 95,762 cubic yards had been removed, giving a channel 300 feet wide and 15 feet deep, mean low water.

The improvements heretofore made in the two channels leading to Perth Amboy and to South Amboy have been of material benefit to commerce, especially to that derived from the Delaware and Raritan Canal through the lower Raritan River.

These benefits would be greatly enhanced, and the channels could be more easily maintained, if the main stem uniting the two channels were extended in a straight line to the eastward from Great Beds Light to connect with the 21-foot curve at the western extremity of the flood channel south of Round Shoal, to which reference has already been made. No survey has been lately made on this line which can be used to determine the exact cost of such an enlargement of the improvement.

The survey of the South Amboy Channel, for which provision was contained in the river and harbor act of August 17, 1894, was completed in December, 1894, and a report thereon submitted to the Chief of Engineers, February 2, 1895.

In that report it was estimated that the projected improvement of the South Amboy Channel, contemplating 21 feet at mean low water, can be effected by the removal of 680,000 cubic yards of material, at the cost of $130,000.

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The steamers and barges navigating this channel actually draw, in many instances, 17 feet of water, which depth can only be obtained in the present channel at high water, necessarily restricting navigation to this stage.

The estimate of $55,000 recommended for the fiscal year ending June 30, 1897, will, if appropriated, complete the project of 1885, and if the improvement is to be continued thereafter a new project and estimate will be required.

The amount expended during the fiscal year ending June 30, 1895, inclusive of outstanding liabilities, was $39,040.93.

This work is in the collection district of Perth Amboy, which is the nearest port of entry. Nearest light-house, Princess Bay. Nearest fort, at Sandy Hook, New Jersey.

AMOUNTS APPROPRIATED.

Application.	Date.	Amount.
Dredging	Mar. 3, 1881	$50,000
Do	Aug. 2, 1882	50,000
Do	July 5, 1884	20,000
Do	Aug. 5, 1886	37,500
Do	Aug. 11, 1888	25,000
Do	Sept. 19, 1890	40,000
Do	July 13, 1892	40,000
Do	Aug. 17, 1894	40,000
Total		302,500

Amount expended to June 30, 1895, inclusive of outstanding liabilities...$299,993.75

Money statement.

July 1, 1894, balance unexpended	$1,547.18
Amount appropriated by act of August 17, 1894	40,000.00
	41,547.18
June 30, 1895, amount expended during fiscal year	29,786.39
July 1, 1895, balance unexpended	11,760.79
July 1, 1895, outstanding liabilities	9,254.54
July 1, 1895, balance available	2,506.25
Amount (estimated) required for completion of existing project	55,375.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	55,375.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for improving Raritan Bay, New Jersey, received in response to advertisement dated September 13, 1894, and opened October 15, 1894, by Second Lieut. Robert McGregor, Corps of Engineers.

No.	Name of bidder.	Dredging material from Seguine Point Channel, 120,000 cubic yards.		Dredging material from South Amboy Channel, 96,000 cubic yards.		Total.
		Per cubic yard.	Amount.	Per cubic yard.	Amount.	
		Cents.		*Cents.*		
1	Atlantic Dredging Co	16⅝	$19,866.67	20 7/10	$19,488.00	$39,354.67
2	Thomas Potter	14 7/10	17,880.00	17¼	17,040.00	*34,920.00
3	The W. H. Beard Dredging Co	18	21,600.00	22	21,120.00	42,720.00

*Lowest bid in the aggregate.

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COMMERCIAL STATISTICS.

The commercial statistics for the fiscal year ended June 30, 1890, have remained practically unchanged, and are therefore herein repeated.

The following statement of the commerce of South Amboy, N. J., and of Raritan River was prepared by Hon. D. C. Chase, mayor of South Amboy, N. J.:

Receipts and shipments.

Articles.	Quantity.
	Tons.
Products of the forest	22,[illegible]
Products of quarries and mines	3,02[illegible]
Animal products	16,[illegible]
Agriculture	37,[illegible]
Manufactures	417,[illegible]
Mechanical and miscellaneous	320,[illegible]
Total	3,845,[illegible]

Total value, $45,075,984.

Vessels arriving and departing.

Vessels.	Number.	Tonnage.	Draft (loaded).
			Feet.
Steamers	6,038	359,300	6 to [illegible]
Barks	40	8,800	8 to [illegible]
Brigs	40	8,800	8 to [illegible]
Schooners	4,138	248,280	7 to [illegible]
Sloops	1,002	52,210	5 to [illegible]
Propellers	4,028	280,982	7½ to [illegible]
Barges and lighters	45,838	2,887,794	7 to [illegible]
Total	61,124	3,845,866	

The following statement of the commerce of Perth Amboy, N. J., for the year 1890 was received from Mr. James Donnelly, superintendent of the New Jersey Division Lehigh Valley Railroad Company:

Lehigh Valley Railroad tonnage eastward and westward over the wharves for the year 1890.

[Gross tons.]

Articles.	Received.	Shipped.	Total.
Coal piers.			
Coal		1,815,521	
Coke		3,058	1,818,579
Freight wharves.			
Grain		125,743	
Steel rails		34,052	
Pig iron	471	87,796	
Iron ore	86,194		
Lumber	33,207	875	
Fertilizer	106		
Clay		5,662	
Miscellaneous	5,867	7,732	
	125,845	261,860	387,705
United Refiners' Export Oil Company's Wharf.			
Oil		60,867	60,867
Grand total			2,267,151

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Number, tonnage, and draft of vessels.

	Number.	Tonnage.	Draft.
Vessels transporting coal.			*Feet.*
Steam	102	500 to 3,000	
Sailing	848	50 to 1,200	
Barges	311	500 to 1,200	
Boats	4,821	100 to 400	
Vessels transporting freight.			
Ocean steamers	10	1,500 to 3,500	19 to 23.5
Sailing vessels	184	500 to 1,200	15 to 18
Lighters	57	200 to 300	6 to 13
Canal boats	1,238	200 to 300	6
Company's wharf.			
Barks and ships	59	500 to 1,500	15 to 18

E 13.

IMPROVEMENT OF SUMPAWANUS INLET, NEW YORK.

[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.]

Sumpawanus Inlet, known in the neighborhood and on the Coast Survey charts as Sumpawams Creek, is a small creek on the south side of Long Island, emptying into the Great South Bay. It lies about 36 miles east of New York City, 15 miles east of the western end of Great South Bay, and nearly twice as far from its eastern end.

The project of improvement provides for dredging a channel 150 feet wide and 5 feet deep at mean low water from the 5-foot curve in the bay to the steamboat dock at the mouth of the creek, a distance of about 1,500 feet, and thence 5 feet deep and 100 feet wide up the inlet to the town of Babylon, a distance of about 3,500 feet farther. The estimated cost of making this improvement is $23,115.

Of this amount $7,000 has been appropriated, the last allotment being included in the act of August 2, 1882. With this sum the channel was given a width of 75 feet and mean low water depth of 5 feet from the steamboat wharf to a point 750 feet below, besides two cuts, each 25 feet wide, alongside the wharf. The improvement has, however, not been permanent, as shown by an examination made in 1886.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

No contracts were in force and no expenditures were made during the fiscal year.

No funds have been available for continuing the improvement since work was suspended in May, 1883.

This work is in the collection district of New York, which is the nearest port of entry. Nearest light-house, Fire Island Light; nearest fort, Fort Hamilton.

The amount of revenue collected at the port of New York during the fiscal year ending June 30, 1895, was $104,125,069.

AMOUNTS APPROPRIATED.

By act of—	
March 3, 1881	$5,000
August 2, 1882	2,000
Total	7,000
Amount expended	7,000

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Money statement.

Amount (estimated) required for completion of existing project	$16,115.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of Sumpawanus Inlet, New York, during the year ending December 31, 1894, were kindly furnished by Hon. James B. Cooper, justice of the peace, Babylon, Long Island.

Articles.	Amount.	Value.
	Tons.	
Oysters	130	$26,000
Fish	300	41,500
Building materials	710	19,450
Miscellaneous	70	6,100
Total	1,210	93,050

Vessels.	Number.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam	4	4½	80
Sail	320	2½	12
Total	324		

E 14.

IMPROVEMENT OF CANARSIE BAY, NEW YORK.

[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.]

The first survey of this bay with a view to its improvement was made in 1879. The scheme of improvement involved a channel 6 feet deep at mean low water and 100 to 150 feet wide, extending from the shore at Canarsie Landing to the navigable channel in Jamaica Bay, a distance of about 3,500 feet. It was thought that the channel might be maintained by the construction of two pile dikes, forming a tidal reservoir. The estimated cost under this project was $88,000. A history of the work in considerable detail is given in the Annual Report of the Chief of Engineers for 1887, Part I, page 637.

The total amount expended on this improvement to June 30, 1894, was $52,997.90, with which two pile dikes had been built and maintained on the north and south sides of the channel at its entrance into Jamaica Bay, 1,058 and 820 feet long, respectively, and the channel dredged to a depth of 6 feet at mean low water and width of about 125 feet from Canarsie Landing to the deep water of the bay. In addition to this, several other improvements not contemplated in the main project, but which added materially to the facility of navigation or to the maintenance of the channel, had been executed, viz, the excavation of a cut 250 feet long and 70 feet wide, with a depth of 6 feet, on the east side of the steamboat landing at Canarsie, and a cut at the end of the wharf at Canarsie Landing 1,300 feet long and 60 feet wide, with a depth of 4 feet, extending through to the southwest to connect with the southwest channel, the latter for the purpose of promoting tidal circulation. The tidal currents are due to a mean rise and fall of 4.7 feet.

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WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

There have been no contracts or expenditures made during the fiscal year.

The river and harbor act of August 17, 1894, appropriated $2,000 for continuing the improvement.

The work will be performed by hired labor, operating the Government dredge *Alpha* and plant when it becomes available, in turn, for this improvement.

The amount that can be profitably expended during the fiscal year ending June 30, 1897, is $10,000.

This work is in the collection district of New York, which is the nearest port of entry. Nearest light-house, Fort Tompkins Light; nearest fort, Fort Hamilton.

The amount of revenue collected at the port of New York during the fiscal year ending June 30, 1895, was $104,125,069.

AMOUNTS APPROPRIATED.

By act of—		By act of—	
June 14, 1880	$10,000	September 19, 1890	$5,000
March 3, 1881	5,000	July 13, 1892	5,000
August 2, 1882	3,000	August 17, 1894	2,000
July 5, 1884	5,000		
August 5, 1886	10,000	Total	55,000
August 11, 1888	10,000	Amount expended	53,000

Money statement.

July 1, 1894, balance unexpended	$2.10
Amount appropriated by act of August 17, 1894	2,000.00
	2,002.10
June 30, 1895, amount expended during fiscal year	2.10
July 1, 1895, balance unexpended	2,000.00
Amount (estimated) required for completion of existing project	33,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of Canarsie Bay, New York, during the year ending December 31, 1894, were furnished by Mr. William Warner, superintendent of the Brooklyn, Jamaica Bay and Rockaway Beach Railroad:

Articles.	Amount.	Value.
	Tons.	
Fish and shellfish	22,200	$256,000
Coal	11,100	37,500
Building materials	50,125	152,000
Fertilizers	50,000	50,000
Total	133,425	495,500

Vessels.	Number.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam	10	5½	300
Sail	84	5½	18
Barges	5	4	150
Yachts	150	3½	4
Total	249	.....	.....

The above table shows an increase of 63,915 tons over that reported for year 1893.

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E 15.

IMPROVEMENT OF SHEEPSHEAD BAY, NEW YORK.

[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.]

Sheepshead Bay, Long Island, is a small tidal bay about 2 miles long, lying inside Coney Island, New York, and extending easterly from the village of Gravesend to Rockaway Inlet, into which it empties. Its width varies from 100 to 1,000 feet, and its depth from 0 to 10 feet at mean low water. The natural entrance is subject to progressive changes of position, due to the action of the waves on the sandy beaches.

The original project for the formation and maintenance of a dredged channel 100 feet wide and 6 feet deep, mean low water, was modified in February, 1889, the modified project contemplating a channel 5,350 long, 60 feet wide, and 5½ feet deep, mean low water, from the town of Sheepshead to within 1,080 feet of Dead Horse Inlet Cut, to connect with the channel of similar width and depth already existing at that point. This channel, which was completed December 6, 1889, seems to have maintained itself in a very satisfactory manner. The estimated cost of the existing project was $34,200.

The amount expended on this project to the end of the fiscal year ending June 30, 1894, was $25,967.95.

With this amount a channel had been dredged 100 feet wide and 6 feet deep at mean low water, connecting the east end of the bay with Dead Horse Inlet, and the interior channel dredged 60 feet wide and 5½ feet deep at mean low water for a distance of 3,400 feet from the town of Sheepshead toward Dead Horse Inlet. The first-mentioned channel, from a survey in 1887, was observed to have not maintained itself, having contracted to a width of 60 feet with an average depth of 5½ feet, mean low water.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

No contracts were in force and no expenditures were made during the fiscal year.

No funds have been available for continuing the improvement since work was suspended in December, 1889.

This work is in the collection district of New York, which is the nearest port of entry. Nearest light-house, Fort Tompkins Light. Nearest fort, Fort Hamilton.

The amount of revenue collected at the port of New York during the fiscal year ending June 30, 1895, was $104,125,069.

Original estimate (1879)	$100,000
Revised estimate (1882)	34,200

AMOUNTS APPROPRIATED.

By act of—	
June 14, 1880b	$3,000
March 3, 1881	5,000
August 2, 1882	3,000
July 5, 1884	5,000
August 5, 1886	5,000
August 11, 1888	5,000
Total	26,000
Amount expended	26,000

Money statement.

July 1, 1894, balance unexpended	$32.05
June 30, 1895, amount expended during fiscal year	32.05
Amount (estimated) required for completion of existing project	8,200.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

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COMMERCIAL STATISTICS.

The commerce of Sheepshead Bay for the calendar year 1892 was estimated at 132,000 tons.

E 16.

IMPROVEMENT OF ARTHUR KILL, NEW YORK AND NEW JERSEY.

[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.]

A history of this improvement, which originated by special resolution of the Committee on Commerce in the Senate, is given in the Annual Report of the Chief of Engineers for 1889, Part I, page 819, and further statement of the comdemnation proceedings necessary for the acquirement of the land forming Steep Point is given in the Annual Report for 1890, page 843. The approved project provides for the removal of this point of land by successive parallel cuts to the regular channel depth, with the object of rectifying the current near the Baltimore and Ohio Railroad Bridge. It is estimated to cost $26,500.

Up to June 30, 1894, $21,470.74 had been expended in acquiring the land and in dredging off about 1⅛ acres of the point, increasing the width of the channel by 225 feet and resulting, as observation shows, in directing the currents more nearly perpendicular to the bridge.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

No contracts were in force during the year.

The river and harbor act of August 17, 1894, appropriated $4,500, the balance of the original estimate, to complete the improvement. Authority to operate by hired labor, using the Government dredge *Alpha* and additional hired plant required in transporting the material to the dumping ground at sea, was granted September 6, 1894.

The plant became available for this work January 4, and the project was completed January 24, 1895. The balance of the meadow land acquired by the United States, about one-fourth acre, was removed to a depth of 13 feet at mean low water, cutting away from the convex shore a strip 10 feet to 20 feet wide and 800 feet long. Seven thousand seven hundred and thirty-eight cubic yards were removed at a cost of 26 cents per cubic yard.

The total amount removed in execution of the project was 75,238 cubic yards, scow measurement, being 96 per cent of the original estimate; the average cost per cubic yard was 24.1 cents, being 81 per cent of the estimated cost.

The deflecting point has been cut away a total of 230 feet normal to the stream, resulting in a rectification of the tidal currents of material benefit to navigation.

The channel width at this point is now 730 feet, with a minimum depth of 13 feet at mean low water.

The amount expended during the fiscal year ending June 30, 1895, inclusive of outstanding liabilities, was $3,930.56.

As the approved project has been completed, no further appropriation is recommended for this improvement.

This work is in the collection district of New York, which is the nearest port of entry. Nearest light-house, Bergen Point Light; nearest fort, Fort Tompkins.

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AMOUNTS APPROPRIATED.

By act of—	
August 11, 1888	$10,000.00
September 19, 1890	7,000.00
July 13, 1892	5,000.00
August 17, 1894	4,500.00
Total	26,500.00
Amount expended	25,201.30

Money statement.

July 1, 1894, balance unexpended	$529.26
Amount appropriated by act of August 17, 1894	4,500.00
	5,029.26
June 30, 1895, amount expended during fiscal year	3,730.56
July 1, 1895, balance unexpended	1,298.70
July 1, 1895, outstanding liabilities	200.00
July 1, 1895, balance available	1,098.70

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of Arthur Kill, New York and New Jersey, during the year ending December 31, 1894, were compiled from statements furnished by parties making shipments over this waterway:

Articles.	Amount.	Value.
	Tons.	
Coal	2,559,862	$8,952,407
Building materials	21,844	186,174
Fertilizers	20,000	55,000
Miscellaneous	721,186	11,321,558
Total	3,322,892	20,515,139

Vessels.	Number.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam	232	12½	475
Sail	1,016	12	450
Barges	10,644	10	275
Total	11,892		

The above table shows a decrease of 61,416 tons when compared with amount reported for year 1893.

E 17.

IMPROVEMENT OF CHANNEL BETWEEN STATEN ISLAND AND NEW JERSEY.

[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.]

A description of this channel and a complete history of the work done toward its improvement may be found in the Annual Report of the Chief of Engineers for 1887, Part I, page 743.

Thus far the improvement has been confined to that portion of the channel (about 1¾ miles long) which lies to the east of Elizabethport,

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N. J., and at the mouth of Newark Bay. This originally had a depth of only 9½ feet at mean low water, while the remainder, lying between the shores of Staten Island and New Jersey, had a depth of from 14 to 40 feet at mean low water.

The present project, adopted October 20, 1890, contemplates dredging the channel to a uniform depth of 14 feet at mean low water over the entire width of 400 feet. The estimated cost of the existing project is $210,000.

The amount expended on this improvement to June 30, 1894, was $199,970.88, and the total amount of work accomplished consisted in the construction of a short dike and the dredging of a channel throughout the entire extent of the improvement, 13 feet in depth at mean low water, with widths varying from 300 to 350 feet. It should be added, also, that for 3,000 feet in the vicinity of the bend at the Stake Light the width had been increased to 400 feet, with low-water depths of from 13 to 14 feet.

An appropriation of $15,000 was made in the act of July 13, 1892. A project for the expenditure of this appropriation in widening and deepening the channel at such points as prove on examination to be most deficient, the work to be done by contract after advertisement and award in accordance with regulations, was approved July 26, 1892.

Work under the project was deferred, pending a survey of the channel in the vicinity of the Corner Stake Light, to determine the amount of shoaling that had taken place at this locality since dredging was last done. This survey was made November, 1893, and showed that the improved channel, with widths of from 300 to 350 feet and depth of 13 feet, mean low water, between Shooters Island and the Corner Stake Light, had contracted in places to a width of about 200 feet; and that in the vicinity of the bend at the Stake Light, where a 400-foot width had been given the channel, with mean low water depths of from 13 to 14 feet, the width corresponding to the aforementioned depths was only about 140 feet.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

There was available at the beginning of the fiscal year, for dredging under authority dated March 17, 1894, by hired labor in operating the Government dredge *Alpha* and additional hired plant, the sum of $13,900.62.

The district plant was transferred from the Raritan River to this improvement July 24, 1894. The Government dredge *Alpha*, tugs *Ant* and *Mary*, and three dump scows, together with two additional hired scows, were employed in widening the contracted channel in the vicinity of the Corner Stake Light. The work progressed rapidly and economically.

Authority to expend the amount appropriated in the river and harbor act of August 17, 1894, $6,000, in continuing the operations then in progress, was granted September 1, 1894.

The Government tug *Ant* was transferred to other work on October 1, and a seagoing tug hired under agreement approved October 2, 1894. The work was carried on continuously until January 4, 1895, when the funds were exhausted.

The total amount dredged and dumped at sea during the year by application of appropriations, acts of July 15, 1892, and August 17, 1894, was 86,667 cubic yards.

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Table of operations, by months.

Month.	Time—		Amount of material dredged and deposited at sea.	Operating expenses and repairs.	Price per cubic yard.
	Worked.	Lost.			
1894.	*Hours.*	*Hours.*	*Cubic yds.*		*Cents.*
July	40.25	10.25	2,928	$2,303.31	78.6
August	223.5	28.5	19,863	3,083.71	15
September	189	41	17,928	3,194.85	17.8
October	188.5	73.5	17,834	3,412.30	19.1
November	186.5	55.5	13,743	2,752.81	20
December	155.25	84.75	13,047	2,781.07	21.3
1895.					
January	16	4	1,325	274.16	20.7
Total	1,009	297.5	86,667	17,802.21	20.5

The cost was 20.5 cents per cubic yard.

The last contract price for work at this locality in 1891, under more favorable conditions, was 26 cents per cubic yard.

The channel at the turn around the Corner Stake Light and westward for a total linear distance of 1,500 feet was restored to the full width of the project, 400 feet; eastward for a distance of 1,100 feet a width varying from 250 feet to 300 feet was secured; an average increase in channel width of 165 feet along the entire linear distance of 2,600 feet dredged throughout to the full depth of the project, 14 feet at mean low water.

The amount expended during the fiscal year ending June 30, 1895, inclusive of outstanding liabilities, was $19,762.32.

The channel at this locality, being unprotected from the drift across the shoal flats of Newark Bay forming its northerly bank, will require frequent redredging to maintain a width sufficient for the traffic constantly passing in either direction.

Fifteen thousand dollars can be profitably expended during the fiscal year ending June 30, 1897, in continuing this improvement.

This work is in the collection district of New York, which is the nearest port of entry. Nearest light-house, Bergen Point Light; nearest fort, Fort Tompkins.

Amount of revenue collected at the port of New York during the fiscal year ending June 30, 1895, was $104,125,069.

AMOUNTS APPROPRIATED.

By act of—		By act of—	
June 23, 1874 (diking)	$50,000.00	August 11, 1888	$15,000.00
August 14, 1876 (dredging)	10,000.00	September 19, 1890	15,000.00
June 18, 1878	15,000.00	July 13, 1892	15,000.00
June 14, 1880	29,000.00	August 17, 1894	6,000.00
August 2, 1882	40,000.00		
July 5, 1884	10,000.00	Total	220,000.00
August 5, 1886	15,000.00	Amount expended	219,733.20

Money statement.

July 1, 1894, balance unexpended	$14,029.12
Amount appropriated by act of August 17, 1894	6,000.00
	20,029.12
June 30, 1895, amount expended during fiscal year	19,762.32
July 1, 1895, balance unexpended	266.80
Amount (estimated) required for completion of existing project	40,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	15,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

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COMMERCIAL STATISTICS.

The following statistics relative to the commerce of channel between Staten Island and New Jersey during the year ending December 31, 1894, were compiled from statements furnished by parties making shipments over this waterway:

Articles.	Amount.	Value.
	Tons.	
Coal	3,581,257	$12,534,299
Building material	35,095	222,944
Fertilizers	90,262	999,148
Miscellaneous	1,502,910	26,741,382
Total	5,209,524	40,497,763

Vessels.	Number.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam	2,557	9½	225
Sail	2,854	8½	183
Barges	20,238	7	180
Rafts	1,242	10	250
Total	26,891	.....	.....

The above table shows an increase of 1,725,613 tons when compared with that reported for year 1893.

E 18.

IMPROVEMENT OF PASSAIC RIVER, NEW JERSEY.

[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.]

The Passaic River is being improved under two separate projects, the first applying to the river below Center Street Bridge, Newark, to and beyond the shoal in Newark Bay, a distance of 7§ miles; the second to the upper course of the river from Center Street Bridge as far as Passaic, a distance of 8 miles. The most recent appropriation was, however, made in a single sum for the entire river, and hereafter the two projects will be united in such a way that the funds can be expended at those parts of the river most urgently needing control or repair in the interests of navigation.

1. BELOW NEWARK.

The lower portion of the river from Center Street Bridge to Newark Bay was first surveyed by the Engineer Department in 1879. The greatest depth in the channel at a point above Elbow Beacon was only 7.1 feet, and in many places the greatest depth was 7.5 feet at mean low water. A project was adopted, based on this survey, providing for obtaining by diking and dredging a channel 200 feet wide and 10 feet deep at mean low water from Center Street Bridge to Newark Bay at a cost of $232,875.

This project was modified in 1884, pursuant to the river and harbor act of that year, providing for extending the dike at the mouth of the river into the bay, a distance of 12,000 feet, and for dredging a channel across the shoal in Newark Bay 200 feet wide and 10 feet deep at mean low water, increasing the original estimate to $353,875.

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The amount expended to June 30, 1894, was $266,582.95, with which 6,205 feet of dike had been built and maintained, the channel through the shoal in the bay and the channel up the river as far as Center Street Bridge, Newark, dredged to the required dimensions. Contraction occurred, materially reducing the width, and in some localities the depth, of the dredged channels. The full dimensions of the project have been restored at all such localities, from the bridge of the Central Railroad of New Jersey to the Center Street Bridge, the upper limit of the section below Newark.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

There were no existing contracts at the beginning of the fiscal year. Work was in progress, under authority dated May 16, 1894, paving the face of the spoil bank behind the stone filled timber dike in Newark Bay, utilizing the stone then being removed from the Raritan River by the Government dredge *Alpha*.

When operations were suspended on the Raritan River, July 29, 1894, the amount of stone which had been placed along the dike was 1,249 cubic yards, in addition to the amount reported at the close of the last fiscal year, making a total of 3,281 cubic yards, and serving to revet the bank up to the line of extreme tidal wash for a linear length of 1,800 feet.

The cost for towing from the Raritan River, discharging, and placing was 65 cents per cubic yard.

The river and harbor act of August 17, 1894, appropriated $15,000 for continuing the improvement.

Authority to expend the allotment in dredging within the limits of the projected channels was granted August 31, 1894. Advertisement inviting proposals for dredging was issued January 15, and proposals opened February 20, 1895. The work was awarded to Alonzo E. Smith, the lowest bidder, at 28.9 cents per cubic yard for dredging below Newark; at 95 cents per cubic yard for dredging and $4.50 per cubic yard for removing bowlders exceeding one-half cubic yard at localities above Newark. Contract was made and approved by the Chief of Engineers March 14, 1895. Dredging below Newark began March 29, and was completed June 7, 1895.

Two dipper dredges were employed upon the channel, and one clam shell at the dike in Newark Bay, making a dumping ground and rehandling material.

Thirty-five thousand cubic yards of mud and sand were removed from the channel below the bridge of the Central Railroad of New Jersey, opening the channel to the full width of 200 feet for a linear distance of 2,700 feet, where the width had contracted since the dredging of 1881 to a width of 50 feet, and giving a depth of more than 10 feet at mean low water.

The spoil was deposited along the embankment thrown up behind the dike in Newark Bay, utilizing material dredged from time to time, and built to protect the dike from the undermining action of the tidal currents flowing to and from the basin inclosed behind the dike by the building of the New York Bay and Waverly Railroad in 1889. The bank was raised to a height of about 8 feet above the top of dike for a linear distance of 2,100 feet, with a slope of about 1 vertical to 5 horizontal.

Under the present condition of the improvement, 9.2 feet at mean low water is the greatest depth that can be carried over a shoal in New-

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ark Bay about 1,500 feet in extent and situated 1 mile below the Passaic Light. The channel through Newark Bay for a distance of 2,000 feet opposite the Passaic Light and for an additional distance of 2,000 feet just above the junction of the Hackensack and Passaic channels has contracted to a width of 100 feet.

2. ABOVE NEWARK.

Before its improvement was undertaken the upper part of the river had a navigable 6-foot channel, except at Middle, Belleville, Rutherford Park, and Holzman bars, where the depths were 4.5 feet, 3.9 feet, 3 feet, and 3.5 feet, respectively.

The project of improvement was adopted in 1872, and provided for a channel across and above the shoals from 7½ to 6 feet deep at mean low water, and from 200 to 50 feet wide, to be obtained by dredging and diking, at a cost of $123,924. It was modified in 1885 by extending the channel below Middle Bar 1,500 feet to the Erie Railroad Bridge, increasing the estimate to $129,000, which was further increased in 1886 to $133,762. The deposit of material from freshets, as well as the difficult and costly nature of the dredging, prompted a recommendation to increase this last estimate to $193,822, which was approved October 6, 1890.

The amount expended to June 30, 1894, was $145,331.22, with which channels had been dredged to the requisite depth, with width of from 60 to 75 feet; a channel through Third River Bar dredged to the required depth, with width of 100 feet for a distance of 800 feet, and below this bar the channel was increased in width by 40 feet, with the same depth for a distance of 700 feet, and by 20 feet for a further distance of 245 feet, giving a continuous 100-foot channel through this reach, having a uniform depth of 6 feet at mean low water.

The channel through Belleville Bar was given a mean low-water depth of from 6 to 7 feet and width of 100 feet; the channel through Holzman Bar widened 35 feet, with a mean low-water depth of from 6 to 8 feet, for a distance of 418 feet, and the channel through Rutherford Park Bar given a similar depth, with a width of 85 to 100 feet, for a distance of 1,035 feet.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

Operations above Newark began May 29, and at the close of the fiscal year 4,161 cubic yards of gravel and 1.16 cubic yards of measured bowlders had been removed from the upper end of Lime Kiln Bar, resulting in a channel width of 110 feet and depth of 7.5 feet at mean low water for a distance of 500 feet below the Montclair and Greenwood Lake Railroad Bridge, an increase in width of 70 feet, and increase in depth below the west draw opening of 2.6 feet, and making both draw openings available for the deepest draft that can be carried to the bridge.

Under the present condition of the improvement vessels drawing 6 feet of water can at mean low-water stage reach the wharves at Passaic City, the head of navigation, distant 8 miles above the Center Street Bridge, Newark.

The depth of 7.5 feet at mean low water secured under the project from the Center Street Bridge to the Montclair and Greenwood Lake Railroad bridge has shoaled at Middle and Lime Kiln bars to a depth of 6 feet; and the channel width at Middle, Lime Kiln, and Rutherford Park bars is not sufficient for safe navigation.

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The amount expended during the fiscal year ending June 30, 1895, inclusive of outstanding liabilities, was $19,951.40.

The entire improvement extends a distance of 16 miles, and the amount that can be profitably expended in maintaining and enlarging the channel dimensions during the fiscal year ending June 30, 1897, is $15,000.

Mr. C. S. Kelsey, assistant engineer, has supervised all works under my charge in New Jersey, and has performed his duties diligently and efficiently.

Passaic River is in the collection district of Newark, which is the nearest port of entry. Nearest light-house, Passaic Light, at the lower end of dike in Newark Bay. Fort Tompkins is the nearest fort.

AMOUNTS APPROPRIATED.

By act of Congress approved—	Below Newark.	Above Newark.	Total.
June 10, 1872		$25,000.00	$25,000.00
March 3, 1873		25,000.00	25,000.00
June 23, 1874		20,000.00	20,000.00
March 3, 1875		20,000.00	20,000.00
August 10, 1876		10,000.00	10,000.00
June 18, 1878		10,000.00	10,000.00
March 3, 1879		2,000.00	2,000.00
June 14, 1880	$30,000.00	2,000.00	32,000.00
March 3, 1881	50,000.00		50,000.00
August 2, 1882	43,000.00	7,000.00	50,000.00
July 5, 1884	25,000.00	3,000.00	28,000.00
August 5, 1886	24,000.00	2,250.00	26,250.00
August 11, 1888	27,500.00	7,500.00	35,000.00
September 19, 1890	40,000.00	5,100.00	45,100.00
July 13, 1892 (for entire river)			45,000.00
August 17, 1894 (for entire river)			15,000.00
Total	239,500.00	138,850.00	428,350.00
Amount expended			424,936.49

Money statement.

July 1, 1894, balance unexpended		$11,435.83
Amount appropriated by act of August 17, 1894		15,000.00
		26,435.83
June 30, 1895, amount expended during fiscal year		13,022.32
July 1, 1895, balance unexpended		13,413.51
July 1, 1895, outstanding liabilities	$5,167.25	
July 1, 1895, amount covered by uncompleted contracts	1,761.83	
		6,929.08
July 1, 1895, balance available		6,484.43

Amount (estimated) required for completion of existing project	109,347.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	15,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3 1893.	

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Abstract of proposals for improving Passaic River, South River, Mattawan Creek, and Keyport Harbor, New Jersey, received in response to advertisement dated January 15, 1895, and opened February 20, 1895, by Lieut. Col. G. L. Gillespie, Corps of Engineers.

No.	Name of bidder.	Passaic River, New Jersey.						Total.
		Dredging material below Newark, N. J. (35,000 cubic yards).		Dredging material above Newark, N. J. (5,500 cubic yards).		Removing bowlders above Newark, N. J. (110 cubic yards).		
		Per cubic yard.	Amount.	Per cubic yard.	Amount.	Per cubic yard.	Amount.	
1	Edgar M. Payne	.....	.....	$1.30	$7,150	$5.00	$550	.....
2	Peter W. Myers	.....	.....	.....	.....	.....	.....	.....
3	The Newburg Dredging Co	.....	.....	.....	.....	.....	.....	.....
4	John H. Fenner	$0.38	$13,300	1.10	6,050	10.00	1,100	$20,450
5	Thomas H. Benton	.29	10,150	.....	.....	.....	.....	.....
6	Elijah Brainard	.32	11,200	1.25	6,875	7.90	869	18,944
7	R. G. & J. S. Packard	.....	.....	.....	.....	.....	.....	.....
8	Alonzo E. Smith	.28 9/10	10,125	.95	5,225	4.50	495	*15,835

No.	Name of bidder.	South River, New Jersey, dredging material (10,000 cubic yards).		Mattawan Creek, New Jersey, dredging material (7,500 cubic yards).		Keyport Harbor, New Jersey, dredging material (20,000 cubic yards).		Mattawan Creek and Keyport Harbor, New Jersey, dredging material (27,500 cubic yards).	
		Per cubic yard.	Amount.	Per cubic yard.	Amount.	Per cubic yard.	Amount.	Per cubic yard.	Amount.
1	Edgar M. Payne	$0.34	$3,400	.....	.....	.....	.....	.....	.....
2	Peter W. Myers	.30	3,000	.....	.....	.....	.....	.....	.....
3	The Newburg Dredging Co	.28	2,800	$0.30	$2,250	.....	.....	.....	.....
4	John H. Fenner	.28	2,800	.....	.....	.....	.....	$0.21	$5,775
5	Thomas H. Benton	.....	.....	.....	.....	.....	.....	.....	.....
6	Elijah Brainard	.38	3,800	.31	2,325	$0.31	$6,200	.31	8,525
7	R. G. & J. S. Packard	.....	.....	.....	.....	.....	.....	.22	6,050
8	Alonzo E. Smith	.29	2,900	.30	2,250	.20	4,000	.20	*5,500

* Lowest bid for Passaic River and Mattawan Creek and Keyport Harbor.

COMMERCIAL STATISTICS.

The statistics relative to the commerce of Passaic River, New Jersey, during the year ending December 21, 1893, furnished by Mr. P. T. Quinn, secretary of the Board of Trade, Newark, N. J., have remained practically unchanged and are therefore herein repeated:

Articles.	Amount.	Value.
	Tons.	
Building materia	315,709	$4,090,280
Iron and ores	221,841	11,092,070
Fertilizers	342,732	3,473,000
Coal	63,750	255,000
Miscellaneous	332,137	19,619,408
Total	1,276,169	38,529,708

Vessels.	Number.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam	8,729	9	475
Sail	5,907	8	200
Barges	4,974	6	200
Rafts	1,213	.....	.....
Total	20,823	.....	.....

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E 19.

IMPROVEMENT OF ELIZABETH RIVER, NEW JERSEY.

[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.]

This stream, which is 2⅝ miles in length from its mouth to the head of navigation at Broad street, Elizabeth, has a width of from 50 to 90 feet, and before its improvement the wharves in the city could only be reached at high water by vessels drawing less than 4 feet. Its commerce was estimated at 45,000 tons annually. The range of the tide was about 4.7 feet at its mouth and 3.4 feet at Bridge street.

The project for the improvement was adopted in 1878, and provides for obtaining, by dredging, a channel 60 feet wide and 7 feet deep at high water from the mouth of the river to the head of navigation, at an estimated cost of $25,530. The estimated cost under the project of 1878 was increased in 1882 to $43,160.

The total amount expended on this improvement to June 30, 1894, was $34,501.47.

A channel of the required dimensions was dredged in 1883 to within 1,000 feet of the Broad Street Bridge, but soon became obliterated by reason of deposits of silt and sewage refuse.

There were no funds available for work on this improvement from 1883 until September 19, 1890, when the sum of $5,000 was appropriated in the river and harbor act of that date, and was expended in 1891 in removing shoals from the river at the bend above South street, at South Street Bridge, at John street, at the bend in the river below John street, and at the New York and Long Branch Railroad Bridge, to the required high-water depth, with widths of from 30 to 50 feet, thus providing a channel having a depth of 7 feet at mean high water from the mouth of the river to within 900 feet of the Bridge Street Bridge, in the town of Elizabeth.

The act of July 13, 1892, also appropriated $5,000 for continuing the improvement, and a project for its expenditure was approved July 26, 1892. A survey at this time indicated a channel from 30 to 50 feet wide, extending from the mouth to Bridge Street Bridge, the head of navigation, with mean high-water depths as follows: From mouth of the river to about 2,400 feet above the New York and Long Branch Railroad Bridge, 7 to 11 feet; thence to within 900 feet of the South Street Bridge, 6 to 7.3 feet; thence to bend above South Street Bridge, 5.3 to 6.9 feet; and from this point to the head of navigation, at Bridge Street Bridge, about 2⅝ miles from the mouth, 4.1 to 5.8 feet.

Bids were invited by public advertisement, dated February 18, 1893, for doing the work in accordance with the above-mentioned project, and none were received at date of opening, March 29, 1893. It was subsequently recommended that this work be left in abeyance until such time as an advantageous offer for doing it could be obtained.

There was no work done on this improvement during the fiscal year ending June 30, 1893.

The project for the application of the appropriation, act of July 13, 1892, was executed by hired labor in the open market during the period from April 23 to June 30, 1894.

The improved channel was extended a distance of 900 feet to within 125 feet of the Bridge Street Bridge, which is practically the head of navigation. The channel was given a width of 45 feet and a depth of 7 feet at mean high water where attainable.

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Early in the work a fixed red shale was uncovered, cropping out on either side from a few inches to 1 foot above the required depth.

Through the centre of the stream, where the eroding action has been greatest, the required depth could uniformly be obtained.

In some places the shale was partially broken down and removed by the dredge bucket, although this was not required by the agreement. The remaining rock here and there along the side next to the wharves is an element of danger to loaded vessels lying aground at low water, and should be removed when the funds available will warrant. There is further work needed along the river below, in redredging shoals formed by the deposits of sedimentary matter, with which the stream is highly charged.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

Under authority dated September 1, 1894, the appropriation of $3,000 made in the river and harbor act of August 17, 1894, became available for dredging by hired labor.

Proposals were invited by public notice of ten days or more, and blank forms sent to all interested parties known to the office. Bids were opened December 4, 1894. The lowest bid received, $1.25 and $3 per cubic yard, respectively, for the two sections specified, was not considered advantageous to the Government and all bids were rejected. The work was not readvertised at that time, as there was no reason for expecting lower bids, in view of the great amount of dredging then under advertisement in the district. No attempt to continue the improvement will be made until fall, as the river being the place of delivery for sewage for the town, the disturbance of the bed by dredging would be offensive to the residents on the banks.

The amount expended during the fiscal year ending June 30, 1894, inclusive of outstanding liabilities, was $2,498.53, in liquidation of outstanding liabilities previously reported.

Elizabeth River is in the collection district of Newark, N. J. Nearest light-house, Bergen Point Light; nearest fort, Fort Tompkins.

AMOUNTS APPROPRIATED.

By act of—		By act of—	
March 3, 1879	$7,500	July 13, 1892	$5,000
June 14, 1880	7,500	August 17, 1894	3,000
March 3, 1881	4,000		
August 2, 1882	8,000	Total	40,000
September 19, 1890	5,000	Amount expended	37,000

Money statement.

July 1, 1894, balance unexpended	$2,498.53
Amount appropriated by act of August 17, 1894	3,000.00
	5,498.53
June 30, 1895, amount expended during fiscal year	2,498.53
July 1, 1895, balance unexpended	3,000.00
Amount (estimated) required for completion of existing project	3,160.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	3,160.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

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COMMERCIAL STATISTICS.

The statistics relative to the commerce of Elizabeth River, New Jersey, during the year ending December 31, 1894, furnished by Mr. Thomas H. Benton, of Elizabeth, N. J., have remained practically unchanged, and are therefore herein repeated:

Articles.	Amount.	Value.
	Tons.	
Building material	12,854	$67,106
Coal	14,500	77,250
Miscellaneous	1,200	6,000
Total	28,554	150,356

Vessels.	Number.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam	5	5	20
Sail	114	6	66
Barges	185	5½	150
Rafts	2	.....	.....
Total	306	.....	.....

E 20.

IMPROVEMENT OF RAHWAY RIVER, NEW JERSEY.

[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.]

In its original condition the Rahway River had a depth of 8 feet and more at mean high water from its mouth to Bricktown, 3⅝ miles; 7 feet to Edgar Dock, 4⅓ miles; 4.4 feet to Milton Avenue Bridge, 4¾ miles, and 4 feet to Main Street Bridge, 5 miles, in the town of Rahway. Its commerce was estimated at 120,000 tons, and three attempts had been made to establish a line of steamboats on the river, but had failed on account of the bad condition of the stream.

The original project for this improvement was adopted in 1878, and provided for dredging a channel 125 feet wide and 8 feet deep at high water from Bricktown to Milton Avenue Bridge, and 100 feet wide from that point to Main Street Bridge. The tide rises about 5 feet at the mouth and 4 feet at the head of navigation.

The amount expended on this improvement to June 30, 1894, was $37,000, with which the channel had been given a depth of 7 feet at mean high water, and width of from 100 to 50 feet to within 550 feet of the head of navigation. Freshet material and sewage refuse have, however, obliterated all trace of this dredging, and under present conditions it will be impossible to permanently deepen the channel.

There has been no appropriation for this work since 1882.

This work is in the collection district of Perth Amboy, N. J., which is the nearest port of entry. The nearest light-house is Princess Bay Light, and Fort Tompkins is the nearest fort.

AMOUNTS APPROPRIATED.

By act of—	
March 3, 1879	$10,000
June 14, 1880	10,000
March 3, 1881	10,000
August 2, 188[illegible]	7,000
Total	37,000
Amount expended	37,000

Money statement.

Amount (estimated) required for completion of existing project	$29,250.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	29,250.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

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E 21.

IMPROVEMENT OF RARITAN RIVER, NEW JERSEY.

[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.]

Before its improvement by the United States the Raritan River had a depth of 8.5 feet at "The Stakes," 3 miles; of 6.5 feet at the "Middle Grounds," 4½ miles; of 7.5 feet at Whitehead Sand Dock, 8½ miles; and between this point and New Brunswick, 12¼ miles above the mouth, the channel was obstructed by a number of rocky shoals, with depths of from 8.4 feet to 6.9 feet at mean low water. The city of New Brunswick, and the Delaware and Raritan Canal, which terminates here, together with extensive brickyards on the South River, had an extensive commerce on the stream, estimated in 1871 at 3,053,857 tons per annum.

The present project was adopted in 1874, and provides for obtaining by diking and dredging, and, where necessary, by drilling and blasting rock, a channel 200 feet wide and 10 feet deep at mean low water, from the mouth to New Brunswick, at a cost of $2,093,662.05. It was modified in 1881, pursuant to the river and harbor act of that year, by adding to it the dredging of the south channel, about 13,000 feet long, 100 feet wide, and 5½ feet deep at mean low water, from Kearney Dock to Crab Island.

Under this project $600,849.04 had been expended June 30, 1894, in constructing the dikes required by the project at "The Stakes" and "Middle Grounds," in dredging channels 200 feet wide and 12 feet deep at mean low water at these points, in drilling, blasting, and dredging a channel of the same dimensions across the rocky shoals at Whitehead Sand Dock, and thence up the river, with a width of 100 feet and depth of 10 feet, to within 1,500 feet of New Brunswick, and the channel to Acken Dock redredged to a mean low-water depth of 6 feet and width of 50 feet from Raritan River to Acken Wharf, a distance of about 600 feet. Under two special allotments made for it in the acts of March 3, 1881, and August 2, 1882, the south channel was dredged to the required depth for a distance of 4,000 feet. These improvements had been of decided benefit to navigation. The commerce of the river was reported in 1887 at 1,675,355 tons, valued at $28,119,173; in 1890 at 1,661,425 tons, valued at $29,877,365; in 1891, 1,566,888 tons, valued at $31,031,299; in 1892 at 1,120,302 tons, valued at $27,694,017, and during the past year it is reported to be 1,138,692 tons, valued at $25,705.57.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

At the beginning of the fiscal year no contracts were in force.

Work was in progress, operating the Government dredge *Alpha* and plant in removing rock from the channel near New Brunswick, previously broken by chisel machine, under contract, continuing the work described at length in the annual report for 1894.

Two thousand nine hundred and fifty-five tons of rock and 194 tons of gravel were removed from the section worked over by the chisel machine, in addition to 4,697 tons reported at the close of the fiscal year ending June 30, 1894, and dredging completed July 29, 1894.

A total of 7,652 tons of rock was removed from the section from June 9 to July 29, 1894, and the channel extended to within 1,100 feet of the canal lock, with a width of 60 feet and depth of 10 feet at mean low water; an addition of 400 feet.

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Disposal of dredged rock.

	Tons.
Towed to Newark Bay for revetment at dike	1,673
Wasted at Raritan River dumping ground	573
Removed by scows of private parties, making application	903
Total	3,149

Cost per ton.

For breaking rock, contract price	$1.25
For dredging (operating expenses only), on scow alongside	.17
For towing in Raritan River	.13¼

The river and harbor act of August 17, 1894, appropriated $20,000 for continuing improvement.

The approved application provides for continuing the rock excavation at New Brunswick, employing the Government dredge *Alpha* and such hired plant as is necessary, reserving $1,000 for repairs to dikes.

Specifications for breaking rock free for dredging were prepared, and, after due approval and advertisement, bids were opened December 26, 1894. All offers were rejected as excessive and the work readvertised.

At the second letting, on February 20, 1895, the work was awarded to Hingston & Woods, the lowest bidders, at 74 cents per ton for rock broken free for dredging, to be paid for on its removal by the United States. The contract was approved March 8, 1895.

During April the contractor built and equipped a drill scow, carrying two traveling steam drills, operated by hydraulic feed and lift.

Drilling and blasting began May 1, according to contract, at a point 1,500 feet below the canal lock at New Brunswick, and has progressed favorably to the close of the fiscal year.

The method of operation is similar to that successfully employed by this firm in the improvement of Oswego Harbor, described in the Annual Report of the Chief of Engineers for 1893.

Drill holes are 3 inches in diameter, spaced from 4 feet to 5 feet apart, and driven to a penetration of 2 feet below the required depth. The average depth of hole drilled is 5.2 feet and the usual charge 2¾ pounds of high-grade dynamite.

The holes are exploded singly, without removing the drill scow.

At the close of the fiscal year 1,449 holes had been drilled and blasted, spaced over an area of 27,330 square feet.

The amount of rock broken is estimated in place at 7,442 tons. The removal of the broken rock will complete a section 400 feet long, begun March 12, 1894, and extend the dredged channel to within 1,100 feet of the canal lock at New Brunswick, with a width of 100 feet and depth of 10 feet at mean low water.

The amount expended during the fiscal year ending June 30, 1895, inclusive of outstanding liabilities, was $18,069.19.

The contract quantities have been too small for economical letting. The amount that can be profitably expended during the fiscal year ending June 30, 1897, is $50,000.

This work is in the collection district of Perth Amboy, which is the nearest port of entry. Nearest light-house, Great Beds Light, in Raritan Bay; nearest fort, fort at Sandy Hook, New Jersey.

AMOUNTS APPROPRIATED.

By act of—		By act of—	
June 18, 1878	$200,000.00	August 11, 1888	$50,000.00
March 3, 1879	60,000.00	September 19, 1890	50,000.00
June 14, 1880	100,000.00	July 13, 1892	40,000.00
March 3, 1881	25,000.00	August 17, 1894	20,000.00
August 2, 1882	25,000.00		
July 5, 1884	35,000.00	Total	631,250.00
August 5, 1886	26,250.00	Amount expended	611,189.78

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Money statement.

July 1, 1894, balance unexpended		$10,400.96
Amount appropriated by act of August 17, 1894		20,000.00
		30,400.96
June 30, 1895, amount expended during fiscal year		10,340.74
July 1, 1895, balance unexpended		20,060.22
July 1, 1895, outstanding liabilities	$328.45	
July 1, 1895, amount covered by uncompleted contracts	7,400.00	
		7,728.45
July 1, 1895, balance available		12,331.77
Amount (estimated) required for completion of existing project		1,462,412.05
Amount that can be profitably expended in fiscal year ending June 30, 1897		50,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for rock breaking in the Raritan River, New Jersey, received in response to advertisement dated January 15, 1895, and opened February 20, 1895, by Lieut. Col. G. L. Gillespie, Corps of Engineers.

No.	Name of bidder.	Breaking rock in Raritan River (10,000 tons).	
		Per ton of 2,000 pounds.	Amount.
1	Hingston and Woods*	$0.74	$7,400
2	John J. Fitzpatrick	2.93	29,300
3	P. Sanford Ross	.75	7,500

* Lowest bid.

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of Raritan River, New Jersey, during the year ending December 31, 1894, were furnished by Hon. D. C. Chase, mayor of South Amboy, N. J.:

	Number.	Tonnage.	Value.
Receipts and shipments:		*Tons.*	
Products of the forests		48,625	
Products of mines and quarries		483,953	
Products of animals		5,294	
Agricultural products		18,212	
Manufactures		359,275	
Miscellaneous merchandise		223,333	
Total commerce		1,138,692	$25,705,057
Vessels arriving and departing	23,203	3,358,222	113,879,070
Grand total		4,496,914	139,584,127

The above table shows a decrease of 307,966 tons over amount of commerce reported for year 1893. It is believed that the tonnage reported for the year 1893 is too large, and that there has been in reality a slight increase in tonnage for the year 1894.

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E 22.

IMPROVEMENT OF SOUTH RIVER, NEW JERSEY.

[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.]

Before the improvement of this stream was undertaken by the United States the navigation of the lower 2½ miles of its course had been abandoned and a canal dredged at private expense from a short distance below Washington to Sayreville, on the Raritan River. In 1880 the mouth of this canal had shoaled to a depth of 6.4 feet at mean low water, and the best depth in the canal, some distance above, had decreased to 3.3 feet. Above Washington a depth of 2.7 feet existed to Bissetts, 3§ miles, and 2.5 feet to Old Bridge, the head of navigation, 6¼ miles above the mouth of the canal at Sayreville. The range of the tide was 5.3 feet at Sayreville.

The project adopted in 1880 provided for closing the river below the head of the canal, correcting the direction of the mouth of the latter, and obtaining by diking and dredging a depth of 8 feet mean low water to Washington, 6 feet to Bissetts, and 4 feet to Old Bridge, straightening the channel at two points by cutting across the meadow, estimated to cost $194,695. This was modified July 30, 1892, by omitting the proposed dredging of the cut-off above Washington and in front of the brickyards, the construction of Dikes H, I, J, K, and L, and substituting therefor the dredging of the section of the river between Washington and the Raritan River Railroad Bridge, reducing the original estimate to $176,795.

The amount expended to June 30, 1894, was $77,039.74, with which the direction of the mouth of the canal has been changed; the dikes below Washington completed and maintained; a small amount of dredging done on a shoal above Washington; a shoal at the mouth of Washington Canal removed, and a channel dredged 60 feet wide through the canal and 50 feet wide across the shoal in the river below Washington, the channel between the Turnpike Bridge and Raritan River Railroad Bridge dredged 50 to 100 feet wide and 6 feet deep, mean low water, and the channel for a distance of 350 feet above the bridge dredged to 4 feet, mean low water, and a width of 70 feet. At Rourke Reach the channel was given a depth of 6 feet at mean low water and width of 60 feet for a distance of 860 feet; in addition a bar opposite Whitehead's brickyard was removed to a depth of 8 feet at mean low water and width of 60 feet for a distance of 450 feet, and at the junction of the canal and South River a channel was excavated 350 feet long, 60 feet wide, and 6 feet deep at the same stage of the tide.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

No work was in progress at the beginning of the fiscal year.

A bar in the South River Canal was reported by Mr. M. A. Edgar, a shipper at South River, and examination made July 27, 1894. A scow, sunk in the shoalest part of the canal, had remained for some weeks until the sand scouring out around the obstruction and lodging below had formed a bar, obstructing the canal after the removal of the wreck.

Authority to expend a small balance available in dredging under open-market agreement was obtained August 2.

A cut 290 feet long, 50 feet wide, and 8 feet deep at mean low water was made, removing 922 cubic yards of sand, at a cost of $450.

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The river and harbor act of August 17, 1894, appropriated $5,000 for continuing the improvement.

The application of the allotment to dredging under contract was approved September 1, 1894. Specifications were approved and issued January 15, and proposals opened February 20, 1895. The lowest offer received, 28 cents per cubic yard for dredging, being made by two responsible bidders, all bids were rejected and the work readvertised.

New proposals were opened March 25, 1895, and work awarded to Elijah Brainard, the lowest bidder, at 25 cents per cubic yard for dredging.

The contract was approved April 13, the work started April 20, and completed June 20, 1895; 15,147 cubic yards was removed from the channel and deposited in the inclosed basin behind Dike F, above the canal.

The channel around the bend at Little Washington was given a width varying from 120 feet to 140 feet, an increase of 50 feet for a distance of 330 feet; a cut 400 feet long and 75 feet wide was dredged through a shoal lying about 2,000 feet below Little Washington; a cut 225 feet long and 50 feet wide dredged through a shoal lying about 3,000 feet below Little Washington; the channel around the bend in South River just below the head of the canal was given a width of 75 feet, an increase of 50 feet, for a distance of 220 feet; a cut 950 feet long and 50 feet wide was made along the canal, dredging at all localities to a depth of 8 feet at mean low water.

The amount expended during the fiscal year ending June 30, 1895, inclusive of outstanding liabilities was $4,833.81.

The amount that can be profitably expended during the fiscal year ending June 30, 1897, is $10,000.

The present condition of this improvement is such that the river can be navigated by vessels of 6 feet draft at all stages of the tide for a distance of about 3 miles above its mouth.

The commerce now employing the deepest draft vessels, however, is along a section of South River westward of southern end of canal and following the old bed of the river to its mouth, not included in the existing project for improvement.

If it is the intention of Congress to expend any portion of future appropriations for the improvement of this reach of South River in addition to the canal route, a new project and estimate is required.

This work is in the collection district of Perth Amboy, which is the nearest port of entry. Nearest light-house, Great Beds Light, in Raritan Bay, New Jersey. Nearest fort, fort at Sandy Hook, New Jersey.

AMOUNTS APPROPRIATED.

By act of Congress approved—		By act of Congress approved—	
June 14, 1880	$40,000.00	July 13, 1892	$7,000.00
March 3, 1881	6,000.00	August 17, 1894	5,000.00
August 2, 1882	10,000.00		
August 5, 1886	5,000.00	Total	83,000.00
August 11, 1888	5,000.00	Amount expended	81,865.82
September 19, 1890	5,000.00		

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Money statement.

July 1, 1894, balance unexpended	$960.26
Amount appropriated by act of August 17, 1894	5,000.00
	5,960.26
June 30, 1895, amount expended during fiscal year	4,826.08
July 1, 1895, balance unexpended	1,134.18
July 1, 1895, outstanding liabilities	7.73
July 1, 1895, balance available	1,126.45
Amount (estimated) required for completion of existing project	93,795.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

Abstract of proposals for dredging in South River, New Jersey, received in response to advertisement dated March 4, 1895, and opened March 25, 1895, by Lieut. Robert McGregor, Corps of Engineers.

No.	Name of bidder.	Dredging South River (15,000 cubic yards).	
		Per cubic yard.	Amount.
		Cents.	
1	The Newburg Dredging Co	25½	$3,881.25
2	Elijah Brainard *	25	3,750.00
3	J. H. Fenner	25 9/16	3,885.00
4	Peter W. Myers	28	4,200.00

* Lowest bid.

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of South River, New Jersey, were furnished by Mr. E. A. Fisher, of Sayreville, N. J., for the year ending December 31, 1894:

Articles.	Amount.	Value.
	Tons.	
Building material	135,000	270,000
Clay	4,000	7,500
Coal and wood	9,500	27,700
Fertilizers	11,000	16,500
Miscellaneous	1,000	2,500
Total	160,500	324,200

Vessels.	Number.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam	1,290	6	67
Sail	255	6	81
Barges	70	6	55
Total	1,615		

The above tables show an increase of 4,240 tons when compared with amount reported for calendar year 1893.

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E 23.

IMPROVEMENT OF KEYPORT HARBOR, NEW JERSEY.

[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.]

Keyport Harbor was originally accessible at low water only to vessels drawing less than 4 feet. Before its improvement was undertaken by the United States a 6-foot channel had been dredged at private expense, which had shoaled in 1872 to 5½ feet and in 1882 to 5 feet, the range of the tide being 4.7 feet. A large commerce was carried on, however, valued at $2,932,000.

The project for the improvement was adopted in 1873, and provides for dredging a channel 4,700 feet long, 8 feet deep at mean low water, and 200 feet wide from the steamboat dock to the 8-foot contour in Raritan Bay, at an estimated cost of $30,475. No money was appropriated for this purpose, however, until August 2, 1882. A subsequent survey showed that material shoaling had taken place in the channel since 1872, the date of the original survey, necessitating an increase of the original estimate to $40,475.

The amount expended on this improvement to June 30, 1894, was $35,391.52, with which (in 1883) a channel had been dredged to the required depth from the 8-foot contour in Raritan Bay to Keyport Wharf, a distance of 5,000 feet, with a width of 200 feet for the first 4,200 feet and 160 feet for the remainder. This channel did not prove permanent, however, having deteriorated to a width of 30 to 50 feet and mean low-water depth of 6 to 7 feet. It was redredged in 1893 to the projected mean low-water depth, with widths of from 70 to 140 feet in front of Keyport Wharf for a distance of 400 feet; for a further distance of 2,200 feet outward a cut 35 feet wide was made along the northerly side of the old channel.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

At the beginning of the fiscal year no contracts were in force, and there were no funds for continuing the improvement.

The river and harbor act of August 17, 1894, appropriated $5,000, the balance of the estimate, for completing the improvement. A project for dredging under contract was approved September 1, 1894.

Specifications were prepared, approved, and issued under advertisement of January 15, 1895.

Proposals were opened February 20, 1895, the work awarded, and contract made with Alonzo E. Smith, the lowest bidder, at 20 cents per cubic yard for dredging.

Work had not begun at the close of the fiscal year, the contractor's plant having been engaged continuously on work at other localities, combined in same contract with the work at Keyport Harbor.

When the existing contract is completed, it is expected that the channel leading from the 8-foot contour in Raritan Bay to the Keyport Wharf will be 100 feet wide and not less than 8 feet deep at mean low water for a distance of 700 feet, thence 7 feet deep for a distance of 2,000 feet, and 6 feet deep for a further distance of 2,300 feet to the Keyport Wharf.

The amount expended during the fiscal year ended June 30, 1895, inclusive of outstanding liabilities, was $4,028.05.

The estimated cost of the project of 1873 has been appropriated, but owing to the long interval since the commencement of the work, and to

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the constant shoalings to which the channel is subject, whose removal could not be effected by the small annual appropriations, the project has not been fully completed.

If the improvement is to be continued a new project with estimates of cost will be required.

This work is in the collection district of Perth Amboy, N. J., which is the nearest port of entry. Nearest light-house, Great Beds Light, in Raritan Bay. Nearest fort, fort at Sandy Hook, N. J.

AMOUNTS APPROPRIATED.

By act of—	
August 2, 1882	$30,475.00
July 13, 1892	5,000.00
August 17, 1894	5,000.00
Total	40,475.00
Amount expended	35,419.57

Money statement.

July 1, 1894, balance unexpended	$83.48
Amount appropriated by act of August 17, 1894	5,000.00
	5,083.48
June 30, 1895, amount expended during fiscal year	28.05
July 1, 1895, balance unexpended	5,055.43
July 1, 1895, amount covered by uncompleted contracts	4,000.00
July 1, 1895, balance available	1,055.43

COMMERCIAL STATISTICS.

The following statement of the commercial statistics for the calendar year 1894 was prepared from statements furnished by shippers:

Articles.	Amount.	Value.
	Tons.	
Produce	172,304	$3,446,080
Brick	200,000	600,000
Fertilizers	300,000	100,000
Coal and wood	6,000	7,500
Miscellaneous	8,865	221,625
Total	687,169	4,375,205

Vessels.	Number.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam	4	6	400
Sail	50	6½	100
Barges	100	6½	200
Total	154	.....	.....

E 24.

IMPROVEMENT OF MATTAWAN CREEK, NEW JERSEY.

[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.]

Before its improvement by the Government this small stream was obstructed at its entrance into Keyport Harbor by a mud flat, on which the best depth at the worst section was 3.1 feet at mean low water, though the 3-foot channel was too narrow and tortuous for use. Above this flat a good 4-foot channel existed to 1⅛ miles above the mouth, and thence to the steamboat dock at Mattawan 3.5 feet, shoaling to 1.8 feet

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at the freight dock 600 feet above and $1\frac{7}{8}$ miles from the mouth. The range of the tide is 4.7 feet. Notwithstanding the above difficulties it carried commerce valued in 1880 at $800,000. In 1885 the commerce of the creek was stated to be 130,000 tons, valued at $2,000,000.

The project for this improvement was adopted in 1881, and provides for dredging a channel 4 feet deep at mean low water and 100 feet wide from the mouth to Winkson Creek, and thence 75 feet wide to the railroad bridge at Mattawan, 250 feet above the freight dock, at an estimated cost of $33,120.

Appropriations were made for this improvement to the close of the fiscal year ending June 30, 1892, as follows: March 3, 1881, $15,000; August 2, 1882, $6,000, and September 19, 1890, $2,500. With the appropriations of 1881 and 1882 the channels had been dredged to the required depth from the mouth to the freight dock at Mattawan with widths of from 100 to 30 feet. The small appropriation of 1890 enlarged the dimensions of the channel through the flat outside the creek nearly to the requirements of the project, and also for a distance of 1,420 feet upstream from its mouth.

The river and harbor act of July 13, 1892, appropriated $9,620 for completing the improvement, and a project for its expenditure in dredging the channels to the full dimensions was approved July 27, 1892. A survey of this stream, begun October 24 and completed November 3, 1892, showed that the channels dredged in 1881 and 1882 had almost reverted to their original condition, and that the amount of work required to complete the project could not be performed with the available funds; consequently a revised estimate for completing the project, increasing the original by $10,000, was submitted for the approval of the Chief of Engineers May 29, 1893.

With the amount appropriated to complete the improvement the channel between the mouth of the creek and steamboat wharf at Keyport was redredged on its southerly side to a mean low-water depth of $4\frac{1}{2}$ feet for a distance of 2,100 feet upstream from Keyport Wharf and given a width of 50 feet for the first 1,500 feet, with 25 feet for the remainder, and on its northerly side redredged to a similar depth, with a width of 25 feet for a distance of 630 feet, extending from Keyport Wharf upstream. From about 500 feet above Winkson Creek to the steamboat dock at Mattawan, a distance of about 4,000 feet, the channel was redredged to a width of 50 feet and mean low-water depths of from 4 to 5 feet.

The amount expended on this improvement to June 30, 1894, was $32,873.64.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

At the beginning of the fiscal year no contracts were in force and no funds were available for continuing the improvement. By the river and harbor act of August 17, 1894, $3,000 was appropriated for dredging.

A project to do the work with hired plant was approved September 1, 1894. After further consideration it was deemed advantageous to the Government to do this work in connection with that at Keyport Harbor combined in one contract.

Specifications were approved and issued January 15, 1895. Proposals were opened February 20, 1895, the work awarded, and contract made with Alonzo E. Smith, the lowest bidder, at 20 cents per cubic yard for dredging. The contract was approved March 14, 1895.

Work had not commenced at the close of the fiscal year, the contractor's plant having been engaged continuously on work at other localities combined in one contract with the work at Mattawan Creek.

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The amount expended during the fiscal year ending June 30, 1895, inclusive of outstanding liabilities, was $1,508.32.

By the application of the appropriation, act August 17, 1894, it is expected that vessels drawing 4 to 4½ feet will be able to reach the wharves at the head of navigation by a channel having a width varying from 100 feet to 40 feet and a depth of from 4 to 5 feet at mean low water.

It has not been possible to complete the original project with the appropriation of the sum of the original estimate because the small appropriations made irregularly did not suffice to remove annual deposits in addition to the excavations originally required.

Appropriations for dredging will be required from time to time to maintain existing channels.

If it is the intention of Congress to complete the original project a new estimate will be necessary.

This work is in the collection district of Perth Amboy, which is the nearest port of entry. Nearest light-house, Great Beds Light, in Raritan Bay. Nearest fort, fort at Sandy Hook, New Jersey.

AMOUNTS APPROPRIATED.

By act of—	
March 3, 1881	$15,000.00
August 2, 1882	6,000.00
September 19, 1890	2,500.00
July 13, 1892	9,620.00
August 17, 1894	3,000.00
Total	36,120.00
Amount expended	32,881.96

Money statement.

July 1, 1894, balance unexpended	$246.36
Amount appropriated by act of August 17, 1894	3,000.00
	3,246.36
Juue 30, 1895, amount expended during fiscal year	8.32
July 1, 1895, balance unexpended	3,238.04
July 1, 1895, amount covered by uncompleted contracts	1,500.00
July 1, 1895, balance available	1,738.04
Amount that can be profitably expended in fiscal year ending June 30, 1897 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	7,000.00

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of Mattawan Creek, New Jersey, during the year ended December 31, 1894, were furnished by Mr. J. W. Maggs, of Mattawan, N. J.

Articles.	Amount.	Value.
	Tons.	
Produce	150,000	$3,000,000
Brick	200,000	600,000
Fertilizers	300,000	100,000
Coal and wood	6,000	7,500
Miscellaneous	2,000	50,000
Total	658,000	3,757,500

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Vessels.	Number.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam	2	6½	228
Sail	50	6½	100
Barges	100	6½	200
Total	152		

The above table shows an increase of 79,300 tons over amount reported for calendar year 1893.

E 25.

IMPROVEMENT OF SHOAL HARBOR AND COMPTON CREEK, NEW JERSEY.

[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.]

Shoal Harbor is situated on the south side of Sandy Hook Bay, 5 miles west of the entrance to Shrewsbury River, New Jersey. The harbor is formed by a slight indentation in the shore line where Compton Creek empties into the bay. The outer harbor is unprotected by projecting headlands or other natural topographical features. The creek is used principally as a harbor for small vessels engaged in the fish and oyster trade, and contains ample depth of water for this purpose, except at the entrance, which nearly runs dry at low water, thus preventing vessels from entering excepting at or near high water.

At a point about one-fourth of a mile above its mouth the creek is crossed by a fixed bridge without a draw, beyond which no vessels ever go. The village of Port Monmouth, located on the left shore of the harbor, is the principal shipping point for garden truck from the adjacent districts, and for fish and oysters taken in the bay.

The plan of improvement adopted in 1884 had in view the connection of the 5-foot mean low-water curve of the creek, on the inside, with the 5-foot curve of the bay by means of a dredged channel 150 feet wide, and the protection of this channel against shoaling by means of a timber dike placed on the west side of the harbor, at a total estimated cost of $64,130.

The first appropriation was made in the act of September 19, 1890, the wording being as follows: "Improving Shoal Harbor and Compton Creek, New Jersey, so as to give a channel 4 feet deep at mean low water, $5,000."

The total expenditure on this improvement to June 30, 1894, was $5,139.29, with which amount the channel was dredged in 1891 to a mean low-water depth of 4½ feet for a distance of 1,200 feet, beginning near the bulkhead at the mouth of the creek, with a width of 100 feet for the first 800 feet and 70 feet for the remainder. A survey was made in October, 1892, from the mouth of the creek, extending through Shoal Harbor toward the bay, for a distance of about 4,000 feet. This survey showed that the improved channel had contracted to widths of from 60 to 80 feet, with mean low-water depths of from 3.2 to 4.2 feet.

An appropriation of $3,000 for continuing the improvement was made in the act of July 13, 1892, and a project for its expenditure in extending the dredged channel toward the deep water in Raritan Bay as far as the funds available will permit, maintaining the width of 75 feet and depth of 4 feet mean low water, was approved July 26, 1892. Specifications were prepared and sealed proposals invited by advertisement, but no bids were received at the date of opening, March 29, 1893, and it was subsequently recommended that the work be left in

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abeyance until such time as an advantageous offer might be obtained to do the work with hired plant.

The approval of the Chief of Engineers was obtained March 20, 1894, for the expenditure of the available appropriation in continuing the improvement by hiring plant to do the work in open market, as the method most economical and advantageous to the Government.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

At the beginning of the fiscal year work was pending under an open market agreement with W. H. Taylor for dredging about 4,400 cubic yards from the channel, at 54 cents per cubic yard, approved by the Chief of Engineers April 9, 1894. The work was started August 6, 1894, the contractor's plant having been employed up to that time on Government work at Elizabeth River, awarded in connection with the work at Shoal Harbor.

Two dredges were employed and the work completed September 1, 1894. Four thousand four hundred cubic yards of sand was removed from the channel in Shoal Harbor, and placed behind bulkheads.

The river and harbor act of August 17, 1894, appropriated $3,000 for continuing the improvement.

A project for dredging with hired plant was approved August 29, 1894. After public notice of ten days or more the work was awarded to W. H. Taylor, the lowest bidder, at 64 cents per cubic yard, and work was commenced at once. Funds were exhausted and operations suspended October 23, 1894. Under this agreement 3,750 cubic yards of sand was removed, a total during the year of 8,150 cubic yards, by the application of appropriations of July 15, 1892, and August 17, 1894, resulting in an increased length to the channel through Shoal Harbor of 655 feet, with a width of 75 feet and depth of 4 feet at mean low water.

The channel now extends out to a depth of 1 foot at mean low water in Raritan Bay.

The amount expended during the fiscal year ending June 30, 1895, inclusive of outstanding liabilities, was $5,794.62.

The sum of $5,000 is recommended for expenditure in the fiscal year ending June 30, 1897, toward extending the improved channel farther toward the 5-foot contour of Raritan Bay.

This work is in the collection district of Perth Amboy, which is the nearest port of entry. Nearest light-house, Navesink Light, and nearest fort, fort at Sandy Hook, N. J.

AMOUNTS APPROPRIATED.

By act of—	
September 19, 1890	$5,000.00
July 13, 1892	3,000.00
August 17, 1894	3,000.00
Total	11,000.00
Amount expended	10,993.91

Money statement.

July 1, 1894, balance unexpended	$2,860.71
Amount appropriated by act of August 17, 1894	3,000.00
	5,860.71
June 30, 1895, amount expended during fiscal year	5,794.62
July 1, 1895, balance unexpended	66.09
Amount (estimated) required for completion of existing project	53,130.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	5,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

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COMMERCIAL STATISTICS.

The following statistics, relative to the commerce of Shoal Harbor and Compton Creek, New Jersey, during the year ending December 31, 1894, were furnished by Capt. Benjamin Griggs, of Port Monmouth, N. J.:

Articles.	Amount.	Value.
	Tons.	
Farm products	52,000	$185,000
Fish and shellfish	25,000	55,000
Coal and wood	4,000	14,500
Fertilizers	18,000	24,000
Miscellaneous	5,000	50,000
Total	104,000	328,500

Vessels.	Number.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam	1	4	496
Sail	165	2	20–50
Total	166	.....	.....

The above table shows an increase of 34,500 tons over that reported for year 1893.

E 26.

IMPROVEMENT OF SHREWSBURY RIVER, NEW JERSEY.

[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.]

In its original condition this river was much obstructed by sand bars, on which the best depths at mean low water were: At the mouth, 3.9 feet; below Highlands Bridge, 5.4 feet; at Lower Rocky Point, 3.6 feet; at Barley Point, 3.3 feet; at Chalmers, 5 feet; at Oceanic, 5.5 feet; below Bellevue, 3.1 feet; at Sea Bright, 4.2 feet; at Jumping Point, 2.6 feet, and at Sedge Island, 2.8 feet.

The project for this improvement was adopted in 1879, and contemplates the formation of a channel 6 feet deep at mean low water and from 300 to 150 feet in width from the mouth of the river to Red Bank, on the North Branch, 8 miles, and to Branchport, on the South Branch, 9 miles, at an estimated cost of $254,562.

The total amount expended on this improvement to June 30, 1894, was $234,423.10.

Thirteen thousand four hundred and thirty-seven linear feet of diking have been built and maintained, and channels dredged of the required depth and widths of from 60 to 200 feet, through all shoals obstructing navigation to Red Bank and points below on the North Branch and to Branchport on the South Branch.

Redredging has been required to maintain the depth at Lower Rocky Point, Barley Point, and Upper Rocky Point on the North Branch, and at Bellevue and Jumping Point on the South Branch.

No expenditures have been made since 1891 in continuation of the permanent improvement, all available funds being required to maintain existing dikes and dredged channels.

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WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1895.

No funds were available at the beginning of the fiscal year for continuing the improvement or for maintaining existing works. The channels were in unstable condition from Lower Rocky Point to Oceanic in the North Branch, and in the vicinity of Sea Bright in the South Branch.

The stability of the training dike, built across the outer bar in 1882, and located most successfully, was in danger from the excessive lowering of the bed of the river along the face. Such protection had been given to the dike at irregular times as the funds available would permit, but at the beginning of the fiscal year a total length of 160 feet had been undermined to destruction.

The river and harbor act of August 17, 1894, appropriated $5,000 for continuing the improvement.

The application of the entire appropriation to the preservation of existing dikes and channels, employing hired labor, and plant was authorized September 1, 1894.

About $2,000 has been expended in repairs to the dike at the outer bar, under open-market agreements with the lowest bidders, after public notice of ten days or more.

The timberwork over a total length of 160 linear feet has been rebuilt, and the section refilled with stone; the iron tie-rods were renewed along the entire structure, and riprap stone applied to the outer 600 feet of the dike to prevent further scour.

The channels remained open during the season of navigation in 1894. During the following winter the channel through the bar above Upper Rocky Point shoaled to such an extent that when navigation opened in the spring this bar could be crossed only at high water, rendering regular trips impossible by steamboats plying on this branch of the river. During April, 1895, regular traffic was restored by dredging a channel through this bar, 150 feet wide, 6 feet deep at mean low water, and 140 feet long.

The steamboats have been running regularly on the South Branch, and no shoals have been reported.

The amount expended during the fiscal year ending June 30, 1895, inclusive of outstanding liabilities, was $3,688.14.

In 1893 the Government made a purchase of land on the peninsula of Sandy Hook, by which the southern boundary of the public lands was extended southerly to within 650 feet of the abutment of the highway bridge which crosses the Shrewsbury River at Navesink Highlands. The new purchase, as well as part of the old reservation, is a low and narrow spit, whose crest is barely 5 feet above mean high water, and is constantly subject to injury by wave action following prolonged easterly or northeasterly storms.

Within the past few years the degradation of the spit has many times been such as to open a way for waves through the spit directly into the Shrewsbury River, followed by sand accumulations, tending to obstruct the navigation of that stream. To obviate suspension of traffic over the Government railroad recently laid along this spit and connecting with the Southern Railroad of New Jersey at Navesink Highlands, the tracks have been laid over the southern approach upon trestles for nearly 2,000 feet, making the road independent of minor sea damages.

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A report was submitted to the Chief of Engineers March 2, 1894, upon the improvement necessary to be made to protect this beach against further degradation, from which the following extract is made:

A project for the improvement of the eastern shore of Government land at Sandy Hook should, in the opinion of this office, have for its object the building up of the isthmus permanently to such a height that a railroad may be economically maintained along it and the navigation of the river behind it may be made secure against deterioration by sea influences.

The slope of the foreshore is somewhat steep out to the 10-foot curve, but beyond that curve the dip of the bed of the sea is at the rate of 1 foot in 200 feet. The shore line is comparatively straight, and no tendency of the sea to make a breach by undermining at any particular point is apparent, and evidence seems to show that previous breaches through the neck have been caused by sea waves—accompanying easterly or northeasterly storms prevailing coincidentally with spring tides—which washed over the neck and gradually lowered its crest until a sufficient inroad was made for the passage of a wide sheet of water moving at high velocity.

These destructive storms occur at irregular times during the year, chiefly from September to March, and seldom continue for a longer period than two or three days. At other times the prevailing seas come from the southeast, and their effect is to build out the beach below low-water line, as well as to diminish depths over the shoals on the foreshore.

Experience in the building of shore protection at the northern end of Sandy Hook teaches that jetties alone on this shore will assist little in protecting the high-water line of building out the foreshore permanently, but for effective application must be combined with continuous structures laid along the shore a short distance below the high-water line.

A structure with a vertical face which offers a positive resistance to the breaking waves will invite its own destruction by undermining where no undermining previously occurred, and will limit sand accumulations behind it to drifts caused by wind action.

The plan which offers the best assurance of success is a riprap wall composed of large and small stone combined, located near the high-water line, from which short jetties will extend outwards to near the 4-foot curve, at intervals of about 500 feet.

The ultimate crest of the wall need not be more than 5 feet above the site, but in order to provide for probable settlement of the stone into the sand it may be best to place the crest at first at about 8 feet above the site.

The waves will break upon the shoals in front, and will carry sand in suspension till the wall is attacked. The broken waves will pass through the voids, carrying the suspended sand with them, an appreciable part of which will be left behind on wave recession. The accumulations so made will in times of storm cessation gradually become compact, and take on a growth of vegetation which in the end may so strengthen and consolidate the neck that the storm waves will be powerless to make a breach through it.

The railroad company built the double-pile revetment (breakwater on the map) by contract at $11.50 per linear foot for timber, pile, and ironwork, exclusive of stone and brush filling. In addition, free transportation was furnished by the company over its road for employees of the contractor and materials to be used. The actual cost per linear foot, all items of expense included, is estimated at $20, approximately.

The riprap extension to the northward, built also by the same company, so far as information is obtainable, cost from $10 to $12 per linear foot. Its cross section is too small, and the slopes were not well planned.

I have the honor to recommend a plan of improvement which provides for the construction of a riprap wall 2,000 feet long, 16 feet wide at base, and 8 feet high, at the following estimated cost:

2,000 linear feet of stone wall, at $15 per foot, including the purchase of a railroad plant to transport material from the Engineer Wharf, Sandy Hook, over Ordnance Railroad to the site	$30,000
Repair of old riprap wall built originally by the railroad company	1,000
Contingencies of engineering and inspection, including maintenance of railroad track	3,000
	34,000

Since the date of this report, the estimate of which was laid before Congress, the sea has advanced upon the foreshore, making the beach

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narrower from sea to river and the crest lower, causing an increase of the estimated cost of protection.

It is recommended that an appropriation of $15,062 be made for continuing the improvement of the Shrewsbury River, which, when appropriated, will exhaust the estimated cost of the adopted project. If the improvement is to continue thereafter, a new project with estimate of cost will be required.

In view of the threatened condition of the peninsula, a further appropriation of $50,000 is recommended for shore protection to maintain the navigation of the Shrewsbury River unimpaired.

This work is in the collection district of Perth Amboy, which is the nearest port of entry. Nearest light-house, Navesink Light. Nearest fort, fort at Sandy Hook, N. J.

AMOUNTS APPROPRIATED.

Old project.

By act of—	
August 30, 1852 (survey)	$1,500.00
March 3, 1871 (dredging)	14,000.00
March 3, 1873 (dredging)	5,000.00
Total	20,500.00

Existing project.

By act of—	
June 18, 1878 (diking)	$18,000.00
March 3, 1879	10,000.00
June 14, 1880	30,000.00
March 3, 1881	86,000.00
August 2, 1882 (dredging)	30,000.00
August 5, 1886 (diking)	10,000.00
August 11, 1888	10,000.00
September 19, 1890	10,000.00
July 13, 1892	10,000.00
August 17, 1894	5,000.00
Total	219,000.00
Grand total	239,500.00
Amount expended	238,065.87

Money statement.

July 1, 1894, balance unexpended	$76.90
Amount appropriated by act of August 17, 1894	5,000.00
	5,076.90
June 30, 1895, amount expended during fiscal year	3,642.77
July 1, 1895, balance unexpended	1,434.13
July 1, 1895, outstanding liabilities	45.37
July 1, 1895, balance available	1,388.76
Amount (estimated) required for completion of existing project	15,062.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	65,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

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COMMERCIAL STATISTICS.

The following statistics relative to the commerce of Shrewsbury River, New Jersey, during the year ending December 31, 1894, were furnished by Capt. James S. Throckmorton, of Red Bank, N. J.:

Articles.	Amount.	Value.
	Tons.	
Produce	250,000	$2,250,000
Oysters and fish	18,000	956,250
Fertilizer	70,000	560,000
Coal	150,000	600,000
Lumber	1,000	20,000
Miscellaneous	450,000	4,000,000
Total	939,000	8,386,250

Vessels.	Number.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam	30	4½	350
Sail	41	3	25
Barges	15	4	25
Rafts	8	.....	.....
Total	94	.....	.....

The above table shows an increase of 202,000 tons over that reported for the year 1893

E 27.

IMPROVEMENT OF MANASQUAN (SQUAN) RIVER, NEW JERSEY.

[This work was in the charge of Capt. T. L. Casey, Corps of Engineers, until October 24, 1894.]

In its original condition this stream had a depth of from 4 to 6 feet at mean low water for several miles above its mouth, and was obstructed at its outlet into the ocean by a sand spit, which had deflected the stream into a channel parallel with the beach, communicating with the ocean across shifting sand bars, on which the best depth did not exceed 1½ feet at mean low water; mean range of tide, 2.4 feet. In severe storms this channel was sometimes entirely closed by sand.

The project for this improvement was adopted in 1879, and contemplated dredging the lower river and obtaining by means of jetties a permanent outlet nearly at right angles to the beach, with a depth of 6 feet at mean low water, at an estimated cost of $52,120. This was increased to $72,000 in 1882, the increase being due to advanced prices and to a proposed increase in the length of the jetties.

The amount expended under this project to June 30, 1887, was $39,000, with which two jetties had been constructed, but neither to its full length, appropriations having ceased in 1882. No permanent improvement has been effected.

A detailed account of this work was given in the Annual Report of the Chief of Engineers for 1891, page 1010 et seq.

There were no expenditures on account of this work during the past fiscal year.

This work is in the collection district of Perth Amboy, N. J., which is the nearest port of entry. Nearest light-house, Great Beds Light, in Raritan Bay; nearest fort, fort at Sandy Hook, New Jersey.

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AMOUNTS APPROPRIATED.

By act of—	
March 3, 1879	$12,0[illegible]
June 14, 1880	20,0[illegible]
August 2, 1882	7,0[illegible]
September 19, 1890	2,0[illegible]
Total	41,0[illegible]
Amount expended	39,0[illegible]

Money statement.

July 1, 1894, balance unexpended	$2,000 [illegible]
July 1, 1895, balance unexpended	2,000.[illegible]
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	31,000.[illegible]

E 28.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

(*1*) *U. S. engineer dredge Flood Rock.*—The U. S. engineer dredge *Flood Rock*, while at work on reef off Sunken Meadow, East River, was run into and sunk on December 23, 1893, by the ferryboat *Wiehauken*.

Sealed proposals for the removal of the wreck were opened January 31, 1894, and contract for raising and removing it was entered into March 8, 1894, with John Austin, of Philadelphia, Pa., for $4,270. This contract expired May 1, 1894, but, with the approval of the Chief of Engineers, it was successively extended to May 31, to June 30, to July 31, and to August 31. The contractor made several attempts to raise the wreck, but failed on account of the inadequacy of his plant.

The work was readvertised January 24, 1895, and sealed proposals were opened February 27. With the approval of the Chief of Engineers, a contract was made with the Chapman Derrick and Wrecking Company on March 13, 1895, for the removal of the wreck for the sum of $4,250. At the close of the year nothing had been done, as the contractor was building a large and powerful derrick for this work.

(*2*) *Barge Milton.*—The barge *Milton*, with a cargo of coal, was wrecked on the north side of reef off Sunken Meadow, Hell Gate, East River, New York, on November 20, 1893. The cargo was removed by the owners and several unsuccessful attempts were made to raise the vessel. On January 20, 1894, the barge slipped off into deep water adjacent to the reef. Two of her masts had been removed before she disappeared and the remaining mast was broken off immediately above the deck by a charge of dynamite laid by the engineer force under this office. During the month of November, 1894, three blasts, consisting of four cartridges each, aggregating 300 pounds of explosive, were fired at separate times on the hull. The result of these blasts was to break up the hull completely, and it no longer offers any obstruction to the currents.

(*3*) *Steamer Canonicus.*—The steamer *Canonicus*, while lying at Starin's Wharf, Port Richmond, Staten Island, on June 18, 1894, caught fire, drifted into Kill van Kull, and sunk in about 40 feet of water, nearly in the center of the channel, 3,700 feet easterly of Bergen Point Light. The steamer was a side-wheel vessel, 178 feet long, 28 feet beam, and 9 feet depth of hold, with a gross tonnage of 540 tons.

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After advertisement according to law, an agreement was made with John S. Bundick, the lowest bidder, for removing the wreck for the sum of $2,300. The wreck was broken up and entirely removed by June 6, 1895.

Abstract of proposal for removing wreck of dredge Flood Rock, East River, New York, received in response to advertisement dated January 24, 1895, and opened February 27, 1895, by Lieut. Col. G. L. Gillespie, Corps of Engineers.

No.	Name of bidder.	Amount bid for raising dredge and towing wreck to some designated point.
1	Chapman Derrick and Wrecking Co.*	$4,250

* Only bid.

E 29.

PRELIMINARY EXAMINATION OF PEEKSKILL HARBOR, NEW YORK.

[Printed in House Ex. Doc. No. 37, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1894.

SIR: I have the honor to submit the accompanying copy of report of November 26, 1894, by Lieut. Col. G. L. Gillespie, Corps of Engineers, giving results of a preliminary examination of Peekskill Harbor, New York, ordered by river and harbor act of August 17, 1894.

Colonel Gillespie reports that, in his opinion, the harbor of Peekskill is worthy of improvement in so far as relates to the excavation of a channel along the entire wharf front, connecting north and south with the deep-water channel of the Hudson River, excluding any work of construction upon the outlying flats. I concur in the views of Colonel Gillespie.

No survey is necessary at this time, sufficient data being already at hand for the preparation of plan and estimate of cost of improvement.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF LIEUT. COL. G. L. GILLESPIE, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., November 26, 1894.

GENERAL: Referring to Department instructions to Lieut. Robert McGregor, Corps of Engineers, dated August 20, 1894, I have the honor to submit herewith report on the preliminary examination of Peekskill Harbor, New York, in compliance with the requirements of the river and harbor act of August 17, 1894.

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This harbor is a prominent indentation upon the eastern shore of the Hudson River at Peekskill. It measures 1 square mile, approximately, east of the 12-foot curve of the river, and the outlying flats, 3,500 feet wide, have a maximum depth over them of 5 feet of water at mean low water. A narrow channel, 6 feet deep at mean low water, follows the shore from north to south past the town docks, and enables steamboats and small craft to transport by water a part of the commerce originating at the town.

The river and harbor act of August 2, 1882, provided for an examination of the harbor with the view to improvement. The local officer declared the harbor worthy of improvement and the work a public necessity; and plans and estimates for the improvement were embodied in a report dated November 28, 1883 (Annual Report Chief of Engineers, 1884, Part I, pp. 718–720). It was stated in that report that "the inhabitants desire to have a channel 10,000 feet in length, from 10 to 12 feet in depth at mean low water, made through the shoals, to extend from their wharves nearly parallel with the shore line up and down stream, and to communicate at both ends with the deep river channel." The estimated cost for such an improvement, affording 10 feet depth at mean low water, was $50,000. It was further stated that the maintenance of such an improved channel might require the construction upon the flats of a tidal basin, at an additional cost of $137,000. Congress made no appropriation for beginning the improvement.

The river and harbor act of August 18, 1888, in the item making appropriation for continuing Hudson River improvement, provided for the discretionary application of $10,000 for the improvement of Peekskill Harbor. In view of the necessities of the Hudson River improvement, then very great, none of the money appropriated by the act of 1888 was applied at Peekskill Harbor.

Congress has since made no specific appropriation for improving Peekskill Harbor.

An examination of this harbor, made by this office in 1889, shows by comparison with the chart prepared from the Coast Survey of 1854 that no material change took place in the depths over the outlying shoals during the interval of thirty-five years. The shoals may therefore be regarded as comparatively permanent.

Early in October letters were addressed to the Member of Congress of the district, and a conference was held later with the citizens of Peekskill, with the object of ascertaining the special reasons claimed by them which make the improvement of this harbor a public necessity.

The reply is given in a letter from a committee of the Board of Trade, Peekskill, dated November 23, 1894, copy of which is herewith transmitted.

By this report it would appear that the annual commerce of Peekskill is represented by 500,000 tons of merchandise, having an estimated valuation of $6,600,000, which is transported in 10 steamboats, 2 freight boats, and 900 sailing craft. The number of passengers carried during the year 1893 was 64,000. Evidence is given also that the city is a great manufacturing and industrial center, which is growing constantly in population and wealth.

In view of this statement, the correctness of which I do not doubt, I have the honor to report that, in my opinion, the harbor of Peekskill is worthy of improvement in so far as relates to the excavation of a channel along the entire wharf front, connecting north and south with the deep-water channel of the Hudson River, enabling vessels and steamers to enter and leave the harbor, north and south, with facility, excluding any work of construction upon the outlying flats.

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No survey will be necessary, as the data already in this office are sufficient for the preparation of a "plan and estimate for its improvement."

Very respectfully, your obedient servant,

G. L. GILLESPIE,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

LETTER OF THE PEEKSKILL BOARD OF TRADE.

PEEKSKILL, WESTCHESTER COUNTY, N. Y., *November 23, 1894.*

SIR: Replying to your letter of October 13, 1894, to the Hon. William Ryan, as a committee of the Board of Trade of the village of Peekskill, and on behalf of the citizens thereof, we have the honor to submit to you the following facts, upon which are based the imperative demands of the village of Peekskill for the improvement of its harbor.

The matter of improvement of Peekskill Harbor has been before your predecessor and the River and Harbor Committee of the House of Representatives several times, and favorably reported upon.

On December 18, 1882, General Newton, then Chief of Engineers, made a report, after examination, "that the channel requiring improvement has at present a depth of less than 5 feet at mean low water. There is no doubt that great inconvenience and embarrassment arise from the limited depth of water, and that the harbor is worthy of improvement, and the work is a public necessity." (See Senate Ex. Doc. No. 57, Forty-eighth Congress, first session.)

On November 28, 1883, General Newton made a very extended report based upon surveys and information furnished to him describing the improvements desired and thought necessary.

In the years 1887 and 1888 the matter was again agitated, and thought worthy at that time by the River and Harbor Committee of the House of Representatives of an appropriation, and the sum of $10,000 was appropriated for the purpose of the work; but owing to the fact that the work was made discretionary, the money was expended in other directions, and Peekskill received no benefit therefrom. (See bill H. R. 9050, March 31, 1888, p. 21, lines 479–482.)

We beg to submit that this improvement is recommended by all the documents and papers on file in the matter, and by the reports of your predecessor, and has been in every instance approved.

In order, however, that you may have full and accurate information as to the condition of Peekskill Harbor—and though in doing so we fear we may repeat much that is contained in the documents hereinbefore referred to—we would submit to you the following facts:

Peekskill is situated 42 miles from New York. It has a resident population of 12,000 within the corporate limits, and in addition thereto, immediately depending upon it, of 12,000 more, and in the summer months this is nearly doubled.

The New York State camp of military instruction is situated here, dependent for its supplies on water transportation; and during the summer months 1,500 men, including attendants, are in camp here. We also have large schools and asylums not included in the population, which will add 2,500 thereto. Our interests are therefore much larger than our quoted population would indicate, and our practical permanent population from all sources double the registered population.

We would call your attention to the following factories in Peekskill:

Three flour and feed mills; 2 paper mills; 4 sash and blind factories; 1 shipyard; 2 boat-building establishments; 1 emery works; 1 pottery; 2 iron-ore mines; 1 hat factory; 2 oilcloth factories; 7 iron and stove foundries; 3 machine shops; 2 underwear factories; 2 nickel-plating works; 1 large lumber yard, shipping to all points on the river; 3 lumber yards; 4 brickyards; 3 bottling establishments; 1 fire-brick works; 1 plaster mill, and many other manufactories.

There are shipped from Peekskill during the year 200,000 stoves, ranges, and heaters, requiring in their production 20,000 tons of pig iron, and consuming 30,000 tons of coal and over 2,000 tons of molding sand. Fifteen million cubic feet of lumber are annually shipped to our docks. Forty thousand tons of coal are used, other than for manufacturing purposes. Twenty-five hundred tons of fire sand, clay, and coal are used for making fire brick. Foundry facings are manufactured here and shipped to all parts of the country.

We would also call your attention to the fact that the Thomas A. Edison Company have purchased the iron mines near Peekskill, and are now preparing to build exten-

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sive works for the purpose of extracting the iron from the ore by Mr. Edison's new process. Mr. Edison proposes that this shall be an immense plant, and thousands of tons of iron will be shipped when the plant is in operation. Superintendent Bachellor will forward us a letter upon the subject, and as soon as received will forward the same to you. This concern alone will double the tonnage of Peekskill.

While it is very difficult to estimate accurately the amount of tonnage shipped here for domestic purposes, it is safe to say that it amounts to $3,200,000.

Peekskill has been and is now suffering from the condition of its harbor. General Newton in 1883 found the depth of the water to be less than 5 feet at mean low water: it is now less.

One wire mill one foundry, and one emery works have been driven from Peekskill by the inadequacy of the depth of water in our harbor, and many manufacturers who attempted to locate have abandoned their project for the same reason.

Formerly iron was shipped from the south, and coal, lumber, lime, gas coal, sand, bluestone, and many other articles consumed and used in manufacturing were shipped to Peekskill without breaking bulk. It is now necessary to break bulk and reship to Peekskill at an increased expense to our dealers and manufacturers of a dollar a ton. Even after breaking bulk and placing it in smaller vessels it is very common that these vessels have to be lightered before they can enter our harbor, and then they can only enter at a most favorable tide.

The Hudson River day boats running to West Point, Poughkeepsie, and Albany are unable to make landing at Peekskill. One oilcloth factory has been obliged to abandon its dock for reason of lack of water and the filling up of the channel. What Peekskill must have, if its prosperity is to continue, is deeper water from the main channel to its docks.

Every year the warning is sounded, unless something is done we will be shut off. We therefore submit to you that we should have a favorable report upon our application.

We append hereto a schedule containing a list of tonnage received and shipped by our manufacturers.

We also append the former reports made in the matter.

All of which is respectfully submitted.

GEO. W. ROBERTSON, *Chairman.*
S. D HORTON, *President Village.*
HENRY L. ARMSTRONG.
JOHN SMITH, Jr.
FRANK M. DAIN.
EDWIN B. LENT.
LEVERETT F. CRUMB, *Secretary.*

Lieut. Col. G. L. GILLESPIE,
Corps of Engineers, U. S. A.

Table of tonnage in manufacturing.

	Shipped and received.	Value.
	Tons.	
Hat factory	25,000	$1,000,000
A. Clark (stone)	1,000	10,000
John McGovern (stone)	500	5,000
J. Hearne (stone)	500	5,000
John Smith, jr. (gravel and felt)	1,000	50,000
Pennsylvania Emery Works	7,000	75,000
R. MacKellar Sons (plaster mills)	1,500	20,000
Peekskill Gas Works	2,000	25,000
E. Lockwood, paper mill	10,000	50,000
Oilcloth factory	15,150	400,000
Union Stove Works, iron foundry	20,000	600,000
Soithard, Robertson & Co., iron foundry	12,000	400,000
Peekskill Stove Works, iron foundry	10,000	350,000
Ely & Ramsey Co., iron foundry	10,100	340,000
I. J. Baxter Iron Works, iron foundry	5,000	15,000
Star Foundry Co., iron foundry	7,000	150,000
C. W. Ellison, flour, feed, and grain	3,500	7,000
G. W. Bagley, steam flour and grain mill	5,530	110,000
Seymour Bros., coal and wood	5,275	100,000
Naylor Bros., machine works	10,000	200,000
New York Stove Works	10,200	400,000
Anderson Machine Works	2,000	50,000
Anderson Electric Works	200	15,000
H. L. Armstrong, coal dealer	25,000	250,000
Andrew Wood, coal and wood	5,000	100,000
Horton & Mabie, fire brick	4,200	125,000
Osborn Shipyard	1,000	100,000

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Table of tonnage in manufacturing—Continued.

	Shipped and received.	Value.
	Tons.	
N. Dain Sons (10,000,000 cubic feet lumber)	22,000	$200,000
M. E. Clinton (1,500,000 cubic feet lumber)	1,500	100,000
Chapman Bros. (800,000 cubic feet lumber)	1,000	25,000
St. Joseph's Home (1,500 inmates)	6,000	250,000
St. Mary s Home (200 inmates)	1,000	200,000
Peekskill Waterworks	4,000	250,000
Baker Underwear Factory	2,000	80,000
Maxwell Shirt Factory	800	20,000
Harrison's Pottery	1,000	5,000
Emery works	500	5,000
Bonner & Cole, brick manufactures (2,000,000)	9,000	122,500
Ale and lager beer	3,500	30,000
C. W. & R. W. Oldfield, brickyard	8,000	124,000
Bonner Brick Co, brick manufacturers	8,000	120,000
Molding sand	225,000	150,000
Wood	15,000	40,000
Limestone	15,000	15,000
	522,955	6,688,500
10 steamboats, 2 freight boats, and 910 sailing and other crafts; passengers carried, 64,000	523,000	14,000,000

E 30.

PRELIMINARY EXAMINATION OF CARRLS RIVER, NEW YORK.

[Printed in House Ex. Doc. No. 40, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1894.

SIR: I have the honor to submit the accompanying copy of report dated October 20, 1894, by Capt. Thomas L. Casey, Corps of Engineers, giving results of the preliminary examination of Carrls River, New York, required by the river and harbor act of August 17, 1894.

It is the opinion of Captain Casey, concurred in by Col. H. L. Abbot, Corps of Engineers, the division engineer, and also by this office, that Carrls River is not worthy of improvement by the General Government.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF CAPT. T. L. CASEY, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., October 20, 1894.

GENERAL: I have the honor to report as follows upon a preliminary examination of Carrls River, New York, as called for by the river and harbor act of August 17, 1894:

Carrls River is one of the many creeks draining the upland down into Great South Bay, Long Island. It is located opposite Fire Island Inlet. The fresh water has been impounded above Carrls River, as in most of these creeks, reducing the stream to an estuary of the bay. The rise and fall of the tide is about 1 foot, and the tidal area being small, the currents are of little force.

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From the mouth of the river to the head of navigation is less than 1 mile. For 2,000 feet in the upper creek the width is less than 100 feet. Here the upland reaches down nearly to the banks of the creek, and the owners, residents of the town of Babylon, have dredged a channel 30 feet wide and 4 feet deep, mean low water, using the material to improve the property on either side. The lower reaches of the creek are wider, the land less valuable, dredging more expensive, and the material of less utility for improvement purposes. Below the dredged channels of from 4 feet to 5 feet in depth, the river continues for 1,000 feet with nearly this depth, gradually shoaling to about 2.3 feet, mean low water. At the outlet into the bay there is a short reach where the depth is less than 2 feet at low water.

The improvement desired is a channel 50 feet wide and 4 feet deep at mean low water, connecting the dredged channel of the upper creek with that depth in the bay. This would require a cut about 2,000 feet long and the removal of about 15,000 cubic yards of material, estimated to cost $5,000.

There is little or no commerce in the river at present. With a depth of 4 feet from the bay into the creek small schooners and barges would land a small amount of coal, brick, broken stone, manure, etc., along the banks and at the public streets running to the river, as is done now at several ports along this bay. No commerce of any proportions could be expected.

The great benefit from this improvement would result to the property owners along its banks, which are taken up for extensive residences, deriving their values from the water facilities of this river. It is this class of residents that make the town, and any improvement of the creek will be a direct benefit to the whole community.

It is estimated that from $5,000 to $10,000 has been expended upon the channels of the creek by private enterprise. This work has gone as far as the conditions will admit of profitable private work. The balance, if performed by the Government, would add to the value of the work already done and benefit all residents and property owners alike along the creek, and indirectly the community of 25,000 people as a whole.

It is to be noted that Sumpawanus Creek, on the eastern side of the town, is just as available for commercial purposes. Its improvement was inaugurated in 1880, and small appropriation made at that time. Congress has not continued the improvement, and the channel has reverted to its original condition.

Having due regard to the commercial aspects of the case, I am of the opinion that Carrls River, New York, is not worthy of improvement by the General Government.

Respectfully submitted.

THOS. L. CASEY,
Captain, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

(Through Col. Henry L. Abbot, Corps of Engineers, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, October 24, 1894.

Respectfully forwarded to the Chief of Engineers. For the reasons stated herein I concur with Captain Casey in the opinion that Carrls

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River, New York, is not worthy of improvement by the General Government.

HENRY L. ABBOT,
Colonel Engineers, Division Engineer.

E 31.

PRELIMINARY EXAMINATION OF GRAVESEND BAY, NEW YORK.

[Printed in House Ex. Doc. No. 31, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1894.

SIR: I have the honor to submit the accompanying copy of report of November 19, 1894, by Lieut. Col. G. L. Gillespie, Corps of Engineers, upon preliminary examination of Gravesend Bay, New York, provided for by river and harbor act of August 17, 1894.

Colonel Gillespie is of the opinion that Gravesend Bay is not worthy of improvement at the present time, and in this opinion I concur.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF LIEUT. COL. G. L. GILLESPIE, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., November 19, 1894.

GENERAL: Referring to Department instructions to Lieut. Robert McGregor, Corps of Engineers, dated August 20, 1894, * * * I have the honor to submit herewith report on the preliminary examination of Gravesend Bay, New York, in compliance with the requirements of the river and harbor act of August 17, 1894.

Gravesend Bay is that part of the Lower Bay, New York Harbor, which lies to the eastward of a line drawn from Fort Hamilton, at The Narrows, to Norton Point, the western terminus of Coney Island. It measures 1½ square miles, approximately, and the average depth in the northern half is 16 feet at mean low water, and in the southern half from 3 feet to 5 feet at mean low water. It is used chiefly as an anchorage for small craft during storms coming from the north round by east to the south. It has ample depth of water for the vessels accustomed to use it.

On the east side there is an inferior water connection with Sheepshead Bay, a distance of 2 miles, approximately, by way of Coney Island Creek, which separates Coney Island from the continental shore. This creek is a very small stream, whose bed is bare in many places at extreme low tide, and which is practicably navigable for only a short distance eastward of Gravesend Bay by reason of deficient depth of water, deficient width, and sinuous course, and by reason of the many railway and highway bridges crossing it, most of which are unprovided with draws.

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The bar at the western entrance to the creek is bare at extreme low water, and the distance thence westward to the 4-foot curve of the Lower Bay, New York Harbor, is 3,000 feet, approximately.

The eastern shore has been built up lately by a number of small towns, originally located as summer resorts, but which have since grown to be places of permanent residence. These places bear the names of Bath, Bensonhurst, Unionville, Gravesend Beach, Gravesend, and Coney Island.

At short intervals along this shore, opposite these towns, piers have been built into the bay for the use of small boats and steam yachts, but they are without commercial importance.

Harbor lines were established on Gravesend Bay by the Secretary of War March 9, 1892. The bulkhead line was located well inshore, but sufficiently far out to admit of the construction of regular and systematic docks or bulkheads, if such are ever required; but the pierhead line was placed near the 12-foot curve of the bay, at the distance of 4,000 feet, approximately, from the western entrance to Coney Island Creek.

Where this creek debouches into the bay an opening was left in the bulkhead line to admit of the future excavation, by private parties owning adjacent property, of the proposed Gravesend ship canal, connecting the outer bay with Gravesend Basin. (See harbor line map, 1892.)

This is a private improvement, designed to develop private property, in which the Government can have no present concern. There is no other point on the bay which merits consideration in relation to any known scheme of improvement designed for the encouragement of commerce.

In the opinion of this office, Gravesend Bay is not worthy of improvement at the present time, in view of any present or prospective demands of commerce.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

E 32.

PRELIMINARY EXAMINATION OF WEST BRANCH OF NEWTOWN CREEK, NEW YORK, FROM METROPOLITAN AVENUE BRIDGE TO THE HEAD OF NAVIGATION.

[Printed in House Ex. Doc. No. 32, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 3, 1894.

SIR: I have the honor to submit the accompanying copy of report dated November 30, 1894, by Lieut. Col. G. L. Gillespie, Corps of Engineers, on the preliminary examination of West Branch of Newtown Creek, New York, "from Metropolitan Avenue Bridge to the head of navigation," ordered by the river and harbor act of August 17, 1894.

Colonel Gillespie, for the reasons given, reports that in his opinion this portion of the West Branch of Newtown Creek is not worthy of

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improvement by the General Government within the meaning and intent of the act of August 17, 1894. I concur in the opinion expressed by Colonel Gillespie.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF LIEUT. COL. G. L. GILLESPIE, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., November 30, 1894.

GENERAL: Referring to Department instructions to Lieut. Robert McGregor, Corps of Engineers, dated August 20, 1894 (* * *), I have the honor to submit herewith report on the preliminary examination of West Branch of Newtown Creek, New York, in compliance with the requirements of the river and harbor act of August 17, 1894, as follows: West Branch of Newtown Creek, New York, from Metropolitan Avenue Bridge to the head of navigation.

The first survey of this creek with the view to its improvement was made in 1879, and extended upstream from the mouth at East River to Vernon Avenue Bridge, a distance of only 2,000 feet.

A second survey was made in 1883, in compliance with the river and harbor act of August 2, 1882. (Annual Report Chief of Engineers, 1884, p. 765.)

At the date of the second survey the head of navigation of the stream was at Metropolitan avenue, where the depth was 4 feet at mean low water in a narrow thread of channel, and the bridge was not provided with a draw.

The work of improvement under modified project of 1883 has all been done from the mouth to Metropolitan avenue.

The harbor lines for this creek, established by the Secretary of War February 8, 1890, and December 29, 1890, stop on both branches at Metropolitan avenue, the recognized head of navigation, and do not take cognizance of any of the private slips, canals, or kills contiguous to the creek.

Originally the east and west branches of the creek, south of Metropolitan avenue, spread out into tiny branches, which ramified and served to drain the marsh lands to the southward that were covered with water at high tide, the range of tides at Metropolitan avenue being $4\frac{1}{2}$ feet, approximately.

Since 1887 the West Branch, south of Metropolitan avenue, has, by the use of dredges, been rectified and deepened by private enterprise, the excavated material being used to reclaim the neighboring marshes; and a navigable canal 1,500 feet long, 160 feet wide, and 10 feet deep at mean low water has been opened, so as to make the adjoining reclaimed lands accessible by water for commercial purposes.

Both banks of the canal have been protected by good revetments, behind which four small private basins on the east side and a larger terminal basin on the south side have been excavated, which enlarge proportionately the water fronts of the reclaimed lands. The canal has shoaled, it is stated, since it was first deepened by pressure of soft loam from the banks and bottom.

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This artificial canal has communication with the main stem of the creek through a double draw in the bridge at the Metropolitan avenue crossing of the Western Branch, placed there since the canal was projected.

The effect of the canal construction is to extend practically the navigation of Newtown Creek southward beyond Metropolitan avenue the above-stated distance of 1,500 feet, terminating near Montrose avenue. The towns of Williamsburg and Bushwick, lying on the west and south sides of the canal, are built up solidly to their dividing line, and the marsh land lying on the east side of the canal is in process of being filled in for conversion into building sites. The canal, therefore, penetrates a progressive section of the country, and will doubtless be largely used in the future for the transportation of all classes of building materials, home supplies, coal, etc.

It is alleged that the object sought by the promoters of this enterprise in having the item for the examination of the West Branch of Newton Creek incorporated in the river and harbor act of August 17, 1894, is that the artificial canal may be placed under the paternal charge of the United States as an extension of the navigable waters of Newtown Creek, so that the canal may have the depth of 10 feet at mean low water maintained by the General Government by allotments taken from future appropriations for the improvement of Newtown Creek. No enlargement or extension of the canal is sought for.

It is to be noted, however, that the canal is a very short one, was built by private enterprise for the reclamation of land for individual profit, and partakes of the nature of a long slip or private canal, made to connect with the navigable waters of the United States.

Attention is invited to the accompanying statement of the commercial statistics of this canal, which has been transmitted to this office in connection with the preliminary survey of the West Branch of Newtown Creek directed to be made by the act of August 17, 1894.

In recommending harbor lines for the approval of the Secretary of War the Harbor Line Board for New York Harbor and adjacent waters has habitually drawn the lines exterior to private basins and slips, such as Atlantic Basin, Erie Basin, Bayonne Basin (Bergen Neck), and inferior river entrances, and when laying down lines specially for Newtown Creek, the water spaces of Whale Creek Canal, Dutch Kills, and other small canals and basins opening into the creek were not considered.

The canal on the West Branch of Newtown Creek has a character similar to that of the private basins and canals just mentioned.

It does not seem a wise policy for the General Government to assume charge, for purposes of improvement or maintenance, of artificial waterways, canals, and basins opened by private enterprise for land reclamation and personal profit, until after Congress has provided therefor by specific legislation, and for this reason I have the honor to report that, in my opinion, the "West Branch of Newtown Creek, New York, from Metropolitan Avenue Bridge to the head of navigation," is not "worthy of improvement" by the General Government within the meaning and intent of the river and harbor act of August 17, 1894.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

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Statistics relative to the commerce of the Newtown Creek Canal, south of Metropolitan avenue, for nine months ending September 30, 1894.

[Furnished by Messrs. C. H. Reynolds & Sons, coal dealers, who have coal yards located upon the canal.]

Unloaded at—	Articles.	Tons.	Value.
Jackson & Burr	Brick (9,000,000)	18,000	$35,000
	Lumber (10,000,000 feet, B. M.)	20,000	170,000
	Stone, rough	20,000	40,000
	Stone, finished and partly finished	1,000	20,000
	Stone, paving blocks	60,000	100,000
	Stone, crushed, for concrete	10,000	20,000
	Iron, manufactured and unmanufactured	2,000	60,000
	Coal	4,000	16,000
	Lime, lath, domestic and foreign cement, etc.	5,000	80,000
C. H. Reynolds & Sons	Coal	150,000	600,000
Knickerbocker Ice Co., Gorman & Wiltse	Ice	75,000	225,000
Klots & Burroughs	Brick (80,000,000 to 90,000,000)	180,000	400,000
	Cement, etc. (200,000 barrels)	30,000	200,000
	Lath (15,000,000)	4,000	30,000
Morgan Avenue Wood Works	Wood (7,200 cords, 30 vessels)	10,800	50,400
Waterbury Mill	Raw materials	7,500	1,200,000
	Coal	2,250	
	Barrels of tar and oil (5,625)	1,055	
Wall Mill	Raw materials	5,250	840,000
	Coal	1,500	
	Barrels of tar and oil (2,750)	516	
Lawrence Mill	Raw materials	2,625	420,000
	Coal	750	
	Barrels of tar and oil (1,875)	352	
Funk Bros.	Oil (35,000 barrels)	7,000	105,000
Total		618,598	4,611,400

E 33.

PRELIMINARY EXAMINATION OF RAHWAY RIVER, NEW JERSEY, TO REPORT UPON THE DESIRABILITY OF PLACING LOCKS IN THE MOUTH OF SAID RIVER AND THE COST OF SAME.

[Printed in House Ex. Doc. No. 30, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1894.

SIR: I have the honor to submit the accompanying copy of report of November 14, 1894, by Lieut. Col. G. L. Gillespie, Corps of Engineers, upon preliminary examination of Rahway River, New Jersey, "to report upon the desirability of placing locks in the mouth of said river and the cost of same," as required by river and harbor act of August 17, 1894.

For reasons given, Colonel Gillespie is of the opinion that Rahway River is not worthy of improvement so far as relates to the desirability of placing locks in the mouth of said river. I concur in this opinion.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF LIEUT. COL. G. L. GILLESPIE, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., November 14, 1894.

GENERAL: Referring to Department instructions to Capt. Thomas L. Casey, Corps of Engineers, dated August 20, 1894, * * * I have the honor to submit herewith report on the preliminary examination of

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Rahway River, New Jersey, in compliance with the requirements of the river and harbor act of August 17, 1894, as follows: "Rahway River, to report upon the desirability of placing locks in the mouth of said river and the cost of same."

The river and harbor act of June 18, 1878, contained provision for the survey of the Rahway River, New Jersey, with the view to its improvement. The survey was made in September, 1878, and a report thereon submitted by the local officer December 27, 1878. (Annual Report, Chief of Engineers, 1879, Part I, pp. 483–485.)

In this report it is stated that "the tidal relations between the upper and lower part of the stream appear to be much the same as those between the upper and lower parts of the Elizabeth River, New Jersey, and the cause is to be found in the same circumstance, viz., the gradual rise in the river bottom from the mouth upward."

The report further says that the practicable way of making the improvement desired by the shipping interest of the river was by dredging.

This method was adopted, and has since been followed.

The appropriations were small, and were barely sufficient to remove annual deposits arising from sewer discharges and from freshets.

No appropriation has been made since 1882, and the river has practically reverted to the conditions existing in 1878, when the depth at low stage was 3 feet, approximately, from the mouth to Brickton, and the river bed was bare at Main Street Bridge, Rahway.

The construction of a lock at the mouth of the river would act as a permanent dam to collect and hold behind it material brought down from the river above or abraded from the banks of the lower river during freshets, resulting eventually in closing the river to navigation unless dredging be resorted to. The period during which the navigation of the river would be extended by the construction of the lock would be inappreciable.

A far greater evil than the deterioration by shoaling would be the excessive pollution of the stream by the retained garbage discharged from the sewers, and the refuse matter emanating from gas works and factories along the banks, resulting in a debased and pernicious sanitary condition of the locality, which would be a menace to the lives of the inhabitants.

The most expedient way of serving the land and sea interests of the community is to maintain by constant dredging an unobstructed inflow and outflow of the water of the sea and of the river.

For these reasons, I am of the opinion that the Rahway River is not "worthy of improvement," so far as relates to "the desirability of placing locks in the mouth of said river," and therefore do not recommend an allotment of money to survey the river with the view of preparing estimates of "cost of same."

Very respectfully, your obedient servant,

G. L. GILLESPIE,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

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E 34.

PRELIMINARY EXAMINATION OF ELIZABETH RIVER, NEW JERSEY, TO REPORT UPON THE DESIRABILITY OF PLACING LOCKS IN THE MOUTH OF SAID RIVER, AND THE COST OF SAME.

[Printed in House Ex. Doc. No. 41, Fifty-third Congress third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 4, 1894.

SIR: I have the honor to submit the accompanying copy of report of November 14, 1894, by Lieut. Col. G. L. Gillespie, Corps of Engineers, giving results of preliminary examination of Elizabeth River, New Jersey, "to report upon the desirability of placing locks in the mouth of said river, and the cost of same," as provided for by river and harbor act of August 17, 1894.

For the reasons given, Colonel Gillespie reports that Elizabeth River is not worthy of improvement so far as relates to the desirability of placing locks in the mouth of said river; and in this opinion I concur.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF LIEUT. COL. G. L. GILLESPIE, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., November 14, 1894.

GENERAL: Referring to Department instructions to Capt. Thomas L. Casey, Corps of Engineers, dated August 20, 1894 (* * *), I have the honor to submit herewith report on the preliminary examination of Elizabeth River, New Jersey, in compliance with the requirements of the river and harbor act of August 17, 1894, as follows:

Elizabeth River, to report upon the desirability of placing locks in the mouth of said river, and the cost of same.

The river and harbor act of June 18, 1878, provided for the survey of Elizabeth River, New Jersey, with the view to its improvement. The survey was made in August and September, 1878, and a report submitted by the local officer December 27, 1878, submitting two projects for excavating channels from the mouth to Broad street, Elizabeth; one project calling for a channel 60 feet wide and 7 feet deep, mean high water, at an estimated cost of $25,530, and the other for a channel 60 feet wide and 8 feet deep, mean high water, at an estimated cost of $33,327 (Annual Report, Chief of Engineers, 1879, Part I, pp. 481–483). The estimated annual tonnage of the river was then 45,000 tons.

The several appropriations made since 1878 have had for their object the improvement of the river according to the first-mentioned project, the estimated cost of which was increased in 1882 to $43,100, the increase of cost being due to annual shoalings throughout the river.

The amount appropriated to date is $40,000. The tonnage in 1891 was estimated at 39,000 tons.

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During the survey of 1878 two tide gauges were set up—one at the mouth of the river and one at Bridge street, Elizabeth—and observations on these gauges determined that the tidal range at the former was 4.7 feet and at the latter 3.4 feet; that at the time of high water the river surface was nearly horizontal, and that the low-water level at the upper gauge was, on an average, 1.3 feet higher than at the lower gauge. It was observed, also, that there was a "gradual rise of the river bottom as we go upstream. In the vicinity of the gas works the river bed rises to about the level of low water at the lower gauge, and continues to rise until in the reach above the last drawbridge it is 2½ feet above this plane."

The report further states that the river undergoes constant shoaling, and ascribes three prominent causes for the deterioration: (1) The dam across the river 1 mile above Broad Street Bridge, diverting one-fourth of the river capacity, to supply water to the city; (2) the discharge of the city sewers into the river, and (3) the discharge of refuse from the gas works.

Three plans were considered for the possible correction of the deteriorating influence: (1) The construction of a tidal basin above Broad street; (2) the resort to slack-water navigation by the construction of a lock at the mouth of the river, and (3) the deepening of the existing channel by dredging. The latter plan, being the only feasible one, was recommended for adoption.

In regard to the construction of a lock, the report says:

> A resort to slack-water navigation by the construction of a lock at the mouth of the river would likewise meet with serious objections, as it would prevent a free discharge of the sewers emptying into the river. The water stagnating would produce malaria and pestilence. Aside from these sanitary considerations, it is probable that the river would shoal up so rapidly that in a few years dredging would become necessary under any circumstances.

The objections advanced against the construction of a lock at the mouth of the river apply with more force to-day than at the date of the report, since the population of the town has increased, and the river labors more to-day under the increased burden of deposits from sewers, gas works, and other industrial interests.

It seems evident that the construction of the proposed lock would be of little use in extending the period of navigation of the river, and would be the immediate cause of rapid deterioration to the improved navigable channel, and of serious detriment to the health of the community.

For the foregoing reasons, this office is of the opinion that the Elizabeth River, New Jersey, is not "worthy of improvement" so far as relates to the "desirability of placing locks in the mouth of said river," and, therefore, no survey is recommended to be made with the view of preparing estimates of "the cost of same."

Very respectfully, your obedient servant,

G. L. GILLESPIE,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

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E 35.

PRELIMINARY EXAMINATION OF INLET AT MOUTH OF SHARK RIVER, NEW JERSEY, FOR HARBOR OF REFUGE.

[Printed in House Ex Doc. No. 73, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1894.

SIR: I have the honor to submit the accompanying copy of report, dated October 23, 1894, by Capt. Thomas L. Casey, Corps of Engineers, of the results of a preliminary examination of inlet at mouth of Shark River, New Jersey, "for harbor of refuge," made to comply with requirements of the river and harbor act of August 17, 1894.

It is the opinion of Captain Casey, concurred in by the Division Engineer, Col. H. L. Abbot, Corps of Engineers, and by this office, that the locality is not worthy of improvement by the General Government.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF CAPT. T. L. CASEY, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., October 23, 1894.

GENERAL: I have the honor to report as follows upon a preliminary examination of the inlet at mouth of Shark River, New Jersey, for harbor of refuge, as called for by the river and harbor act of August 17, 1894:

Shark River discharges into the Atlantic Ocean through an inlet in the beach about 20 miles south of Sandy Hook. Two preliminary examinations of this river, as a work for improvement, have been made previous to the present order for an examination as to its merits as a harbor of refuge.

An examination and survey, followed by an adverse report, was made by Colonel Michler in 1880. (See Annual Report of Chief of Engineers for 1881, Part I, p. 730.) A second preliminary examination, followed by an adverse report, was made by Major Raymond in 1890. (See Annual Report of Chief of Engineers for 1891, Part II, p. 1092.)

There is no harbor of refuge on the coast from Sandy Hook to Barnegat, a distance of 50 miles. The most available inlets and bays are Manasquan, 26 miles below Sandy Hook, and Shark River, 20 miles below Sandy Hook. The inlets are similar in character. Manasquan is much more extensive than Shark River.

Above the inlet at Shark River there is a narrow 4-foot channel, nowhere more than 100 feet wide. It extends three-fourths of a mile up the river, where there are two fixed bridges. Manasquan is more central in location; the width and depth of the channel and the volume of the tidal basin are much more extensive, and there are partial works of improvement at the inlet, built by the Government, that might be available for extension. Probably no greater permanent depth than 4 feet at mean low water could be obtained through either inlet, and the harbor could serve as a refuge only for fishermen and yachts.

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Works that would promise any hope of success in maintaining even a depth of 4 feet through the inlet were estimated by a Board of Engineers, in the case of Manasquan, to cost above $200,000. Unless a large percentage of the estimate were available for the rapid advancement of the work to completion, failure would be almost certain.

The inlet at Shark River is at present obstructed by a row of close piling, driven normal to the coast line on the north shore by landowners, to hold back the northward progress of the inlet and reclaim certain lands. This being partially an open structure, and the reaction along the line causing the sand to scour out here faster than at any other point and with equal ease on either side, has had the effect of drawing the inlet channel up to the row of piling, and the latter now occupies the axial line of the inlet, which is not more than 40 feet wide at low water and 1.5 feet deep. This is probably a permanent or at least a recurring condition. It would make the passage of the inlet much easier for the boats now using it could 400 feet of this piling be removed or the entire structure made a close one.

I am of the opinion that the inlet at mouth of Shark River, New Jersey, for harbor of refuge, is not worthy of improvement by the Government.

Respectfully submitted.

THOS. L. CASEY,
Captain, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

(Through Col. Henry L. Abbot, Corps of Engineers, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, October 25, 1894.

Respectfully forwarded to the Chief of Engineers. For the reasons stated, I concur with Captain Casey in regarding the inlet at the mouth of Shark River as unworthy of improvement by the General Government.

HENRY L. ABBOT,
Colonel Engineers, Bvt. Brig. Gen., U. S. A.
Division Engineer.

E 36.

SURVEY OF RARITAN BAY, NEW JERSEY, BETWEEN SOUTH AMBOY AND GREAT BEDS LIGHT, WITH A VIEW TO DEEPENING THE CHANNEL TO 21 FEET AT MEAN LOW WATER.

[Printed in House Ex. Doc. No. 298, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., February 5, 1895.

SIR: The river and harbor act of August 17, 1894, contains an appropriation of $40,000 for "improving harbor at Raritan Bay, New Jersey," and provides that "this appropriation shall include a survey between South Amboy and Great Beds Light, with a view to deepening the channel to 21 feet at mean low water."

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I have now the honor to submit the accompanying copy of report of February 2, 1895, by Lieut. Col. G. L. Gillespie, Corps of Engineers, with map,* of the results of the survey thus provided for.

Lieutenant-Colonel Gillespie states that the length of the waterway between the 21-foot curves is 7,300 feet, approximately, and the amount of material necessary to be removed, to give throughout this length a width of 300 feet and a depth of 21 feet at mean low water, is estimated to be 680,000 cubic yards. If the work be done in one year, at the existing contract price of 17½ cents per cubic yard, the cost of completion of the project, adding 10 per cent for contingencies, will be $130,000, approximately.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF LIEUT. COL. G. L. GILLESPIE, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., February 2, 1895.

GENERAL: I have the honor to state that the river and harbor act of August 17, 1894, appropriating $40,000 for continuing the improvement of Raritan Bay, New Jersey, provides for "a survey between South Amboy and Great Beds Light, with a view to deepening the channel to 21 feet at mean low water."

The original project for the improvement of South Amboy Channel, adopted in 1885, contemplates a channel length of 3,300 feet, a width of 300 feet, and a depth of 15 feet at mean low water.

The new survey required to be made by the act of 1894 was completed during the month of December, 1894, under the direction of Mr. G. W. Kuehnle, assistant engineer, copy of whose report is herewith inclosed.

The length of the waterway between the 21-foot curves is shown on the accompanying chart to be 7,300 feet, approximately, and the amount of material necessary to be removed to give throughout this length a width of 300 feet, and a depth of 21 feet at mean low water, is estimated to be 680,000 cubic yards.

If the work be done in one year, at the existing contract price of 17½ cents per cubic yard, the cost of completion of the project, adding 10 per cent for contingencies, will be $130,000, approximately.

When work was suspended on this improvement, July 14, 1893, the full projected width and depth had been reached, but, as stated in the Annual Report for 1894, the channel is subject to constant deterioration by deposits, and frequent dredging is required to maintain the improved depths. It is thought that the cost of maintenance will be less in proportion as the improved depth is made greater.

The shoalings during the past two years have been slightly less than formerly, still there is now a continuous reach of the channel, embracing the angle where change of direction occurs, 2,000 feet long, over which the depth is less than 14 feet at mean low water.

When the contract of October 30, 1894, which provides for the removal of 96,000 cubic yards of material from this channel, is com-

*Omitted; printed in House Ex. Doc. No. 298, Fifty-third Congress, third session.

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pleted it is estimated that the projected width and depth will be restored.

The necessity for increasing the existing depth in this channel is shown by the accompanying letter from the mayor of the city of South Amboy, N. J. The main point made is that the coal barges coming out of Raritan River and bound for New York City arrange their arrival at Great Beds Light so as to catch the first of the flood tide and go with it through Arthur Kill and Kill van Kull to upper bay of New York Harbor. As these barges sometimes draw 17 feet and over, the South Amboy Channel, with only 15 feet at low water, must be cleared before the new tide sets, otherwise one tide will be lost. Such a delay materially interferes with prompt and economical delivery of coal supplies to ocean steamers.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

REPORT OF MR. G. W. KUEHNLE, ASSISTANT ENGINEER.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., January 28, 1895.

SIR: In compliance with your orders, I have the honor to submit the following report on the survey of the channel between South Amboy and Great Beds Light, Raritan Bay, New Jersey, made in accordance with the requirements of river and harbor act of August 17, 1894:

The survey was made in the usual manner by the hydrographic party in charge of Mr. John Johnstone, under directions from this office, during the month of December, 1894. It extends from the wharves at South Amboy to the 21-foot channel running from Perth Amboy to Seguine Point.

This channel forms the connecting link between Raritan River and the Lower Bay, New York Harbor, and carries the commerce of Raritan and South rivers and of South Amboy. South Amboy is the principal eastern terminus for the coal traffic of the Pennsylvania Railroad, and supplies a great part of the coal used by ocean steamers, which can be carried economically only in barges of deep draft. The draft of the large barges now used in this traffic is 17 feet, and they can leave South Amboy only at high water. The present channel depth is inadequate to the demands of navigation, and should be increased to 21 feet at mean low water, the same depth as that to Perth Amboy, on the opposite side of the bay.

The estimated quantity of material required to be removed to give a channel 7,300 feet long, 300 feet wide, and 21 feet deep, mean low water, is 682,000 cubic yards, including an allowance of 1 foot for overdepth and one-third increase in bulk for scow measurement, and exclusive of the amount now under contract. The material is mainly hard, compact sand, with a little overlying mud. The cost of removing this material will probably not be less than 20 cents per cubic yard, making the estimated cost of this project, including 10 per cent for inspection and contingencies, $150,000.

Very respectfully, your obedient servant,

G. W. KUEHNLE, *Assistant Engineer.*

Col. G. L. GILLESPIE,
Corps of Engineers, U. S. A.

LETTER OF MR. D. C. CHASE.

OFFICE OF THE MAYOR,
South Amboy, N. J., January 22, 1895.

DEAR SIR: I have the honor to acknowledge the receipt of your favor of yesterday, and in reply beg respectfully to say the contents in your report for 1892, Appendix E, page 836, paragraph 2; for 1893, last paragraph on page 1073; and for 1894, page 783, paragraph 8, was what prompted us to call your attention to the ground-

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ing of vessels in the improved channel between South Amboy and Great Beds Light, but those that I gave you are only such as grounded when in charge of one line; there are many others. You will notice from my report that these were tows, generally containing several boats, the draft of the vessels being from 17 to 7 feet, the grounding of the deeper ones in the center of the dug channel each time resulting in the grounding of them all by their swinging to the sides of the channel, where there is less water; but the number of vessels grounding is few compared to what it was before the improvements that you have brought about by dredging there.

I think you are fully aware of the way in which the vessels are handled between the Raritan River and points on the South Amboy side of Great Beds in New York Harbor, intermediate points, and to Sound ports. Vessels come down the river and from points that side of Great Beds to below Great Beds Light with the last of the ebb tide and by the first of the flood up Staten Island Sound and through to New York while that flood tide lasts, except many of the deepest barges, which are brought over the shoal between South Amboy and Great Beds Light at high water and anchored at the tail of Great Beds until the first of the next flood. But the principal traffic there is handled in a way to make it absolutely necessary that they lose no time that can be avoided in transit. Much of it goes to mail steamships, which can not receive their fuel until in the proper condition, which is brought about by the discharge of their cargo, and then must get it in quickly in order to sail at their stated times. When one of the tows, as shown by the report I sent you yesterday, grounds, of course, as you are aware, it can not again float until the tide has run flood sufficiently long to raise the boats from the bottom; then in bucking the tide the balance of the way to around Great Beds Light is slow work, and it results in all the boats in the tow and their cargoes losing one tide, or about twelve hours, and has caused the delay of mail steamships and others, as well as the shutting down of manufactories, to which some of the cargoes were consigned.

Another reason for my sending you the report was the fact that I appeared before the River and Harbor Committee of the last Congress, and not only succeeded in getting a further appropriation for the improvement of the channel between South Amboy and Great Beds Light, but a survey of the project of deepening it to 21 feet at mean low tide. I thought possibly you might send a report, with the result of your survey, and was anxious that it might not contain a clause like those in your last three annual reports above referred to.

I should be glad to give any further information that you may desire.

Very respectfully,

D. C. CHASE.

Col. G. L. GILLESPIE,
Corps of Engineers, U. S. A.

E 37.

MODIFICATION OF HARBOR LINES IN EAST RIVER, NEW YORK, IN THE VICINITY OF RIKERS ISLAND.

HARBOR LINE BOARD,
New York City, October 3, 1894.

GENERAL: The New York Harbor Line Board has had under careful consideration the petitions of the trustees and citizens of Flushing and College Point, N. Y., with accompanying documents, praying for a reconsideration of the harbor lines established by the Secretary of War, under date of January 24, 1893, referred to the board by your indorsement of August 24, 1894; and has the honor to submit the following report thereon:

Upon receipt of these papers notification was sent to the authorities of the city of New York and to the petitioners that a public hearing would be held to consider the matter at the Army Building, in New York City, on September 4, 1894.

Prior to this hearing additional petitions were received from numerous masters and pilots navigating the East River, praying for a modification of the established lines. They are appended to this report and marked A.*

*Not printed.

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Upon application of the Board an examination of the site in question was made by Lieut. Robert McGregor, Corps of Engineers, in temporary charge of the district of Lieut. Col. G. L. Gillespie, Corps of Engineers, giving information as to the present condition of the works. His letter,* with accompanying maps,* is appended, marked B.

The hearing was held on September 4, and a stenographic report* of the proceedings is appended and marked C. Upon a request of Mr. Charles Blandy, the assistant corporation counsel representing the city of New York, agreed to by the petitioners, an adjournment was taken to October 3 to enable him to properly prepare his case.

Prior to this adjourned hearing plates of the official surveys made along the established lines were, upon request, received from the dock department of the city of New York. These plates* are appended, marked D.

The adjourned hearing was held on October 3. A stenographic record* of the proceedings is appended, marked E. The Board, upon invitation of Mr. F. A. Schermerhorn, representing the petitioners, then made an examination of the site in question.

It will be noted from the papers above enumerated that the following points were made by the petitioners:

(1) Although the meeting of January 16, 1893, at which the established lines were recommended by the Board, was duly advertised, it did not come to the knowledge of the parties interested in opposing the extension of the harbor lines then in force; otherwise, they state, a vigorous protest would have been made at that time. The records of the meeting sustain this claim, as no opposition was made, although specially invited by the Board.

(2) The established lines permit extensive filling of an area now used by small vessels as an anchorage ground when the weather is unsuitable for venturing upon the Sound. If they are excluded from this area they will be forced to anchor in deeper water, now used by larger vessels, and the channel will thus be obstructed and navigation impeded for the Sound steamers. As a matter of fact, this area is indicated as an authorized anchorage ground upon the maps issued by authority of the Secretary of the Treasury; indeed, it is one of the only two in the harbor of New York permitted to be used by barges serving as stores for explosives.

(3) If the filling now authorized be permitted, ferryboats carrying large numbers of passengers, especially in the summer season, will be forced out of their usual tracks and compelled to adopt others longer and more dangerous in thick weather.

(4) The obstruction at the mouth of Flushing Bay which will be caused by filling now authorized will interfere with the early breaking up of ice in the spring, and thus will prejudice navigation in that bay.

(5) Interfering with the natural flow of the tides in Flushing Bay by obstructing its mouth to the extent proposed may cause deposits therein, and thus impair its usefulness for navigation.

(6) The mode adopted for so much of the authorized filling as has already been made has had the effect of creating a public nuisance, endangering the public health. This matter, having no relation to the duties prescribed for the War Department by the United States statutes, has not been regarded by the Board as pertinent to the question at issue.

Although not attaching so much importance to some of these claims as do the petitioners, the Board is still of opinion that they have sub-

* Not printed.

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stantial ground for their application for a revision of the established lines. The grounds upon which the extension was granted in 1893 were two in number, namely, to provide a place for deposit of the city refuse which would avoid the necessity of towing it to sea and to furnish an area on which to construct buildings for official charitable purposes.

Upon a careful consideration of all the points involved, the Board is of opinion that a curtailment of the area now authorized for filling is practicable which will meet all reasonable demands of navigation and of the parties locally interested without depriving the city of any grant essential to the public objects in view.

The water area thus conserved will furnish a needed anchorage ground for small vessels, will remove all grounds of complaint on the part of ferry companies, will afford free passage for ice in the spring and for tidal flow at all times, and will only deprive the city of a site which, when filled, would be ill adapted to receive large buildings by reason of very difficult foundations.

The board therefore recommends that the lines established on January 24, 1893, be modified as follows, the same being also shown in red on the map * herewith submitted.

DEFINITION OF THE LINES RECOMMENDED.

The lines established on January 24, 1893, to be retained except in the following particulars:

Starting on the established pier and bulkhead line on course N. 53° 20′ W., and at a distance of 320 yards eastward from the turning point between said course and course N. 77° W., the new pier and bulkhead line to be extended in a straight course and in a southerly direction until it intersects the established pier and bulkhead line on course N. 85° 45′ E. at a distance of 235 yards eastward from the turning point between said course and course S. 78° 50′ E. The bearing of said new pier and bulkhead line to be about N. 6° 30′ E. and its length about 897 yards. Also all pier and bulkhead lines heretofore authorized to the eastward of said new pier and bulkhead line to be canceled, withdrawn, and made of no effect.

Respectfully submitted.

HENRY L. ABBOT,
Colonel of Engineers, Bvt. Brig. Gen., U. S. A.
WM. P. CRAIGHILL,
Colonel, Corps of Engineers.
HENRY M. ROBERT,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
October 10, 1894.

Respectfully submitted to the Secretary of War.

A protest,* herewith, having been made against certain work at Rikers Island proposed by the municipal authorities of New York, the subject was referred to the New York Harbor Line Board for consideration.

* Not printed.

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The Board in the within report recommends modification of the harbor line for this locality established by the Secretary of War January 24, 1893, and the modification recommended is described in this report and shown by red line on the accompanying map.

It is recommended that the recommendation of the Board be approved and that the Secretary of War place his approval on this report and on the accompanying map.

Previous papers herewith.

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

[Second indorsement.]

WAR DEPARTMENT, *October 29, 1894.*

Approved as recommended by the New York Harbor Line Board and the Chief of Engineers.

JOSEPH B. DOE,
Acting Secretary of War.

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